Economic Analysis of Management Alternatives for Personal Watercraft in Cape Lookout National Seashore

Final Report

December 2005

Prepared for

National Park Service
Environmental Quality Division
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Contents

1. Introduction 1-1

1.1 Organization of Report 1-2

1.2 Problem Addressed by Regulation 1-3

1.3 Current PWC Activities at CALO 1-4

1.4 Proposed Regulations 1-5

1.4.1 Alternative A: Reinstate PWC Use Under a Special Regulation as Previously Managed 1-5

1.4.2 Alternative B: Reinstate PWC Use Under a Special Regulation with Additional Management Restrictions (Preferred Alternative) 1-7

1.4.3 Alternative C: No-Action (Continue PWC Ban) 1-9

2. Baseline Description of PWC Use in Cape Lookout National Seashore 2-1

2.1 PWC Area Access, Maintenance, and Enforcement 2-2

2.2 Visitation Data 2-4

2.2.1 Historical CALO Visitation Data 2-4

2.2.2 Historical CALO Watercraft Visitation Data 2-5

2.2.3 Projected Visitation 2-7

2.2.4 Sources of Uncertainty in Visitation Projections 2-10

2.3 Alternate Locations for PWC Use Nearby 2-12

2.4 Other Major Summer Activities in CALO 2-12

2.5 Natural Resources and Likely Ecological Impacts of PWC Use in Park 2-13

2.5.1 Water Quality....2-14
2.5.2 Air Quality....2-17
2.5.3 Soundscapes....2-20
2.5.4 Wildlife and Wildlife Habitat....2-21
2.5.5 Threatened, Endangered, and Special Concern Species....2-25
2.5.6 Shorelines and Shoreline Vegetation....2-27
2.5.7 Cultural Resources....2-29
2.6 Economic Activity in the Surrounding Communities....2-30
3. Economic Impact Analysis of Reinstating PWC Use in Cape Lookout National Seashore 3-1
3.1 Scenarios Examined in this Report....3-3
3.2 Economic Impact of PWC Regulations on Local Economies....3-7
3.2.1 Effect of Management Alternatives on CALO Visitation....3-7
3.2.2 Impact of Management Alternatives on Local Business Output....3-8
3.2.3 Change in Value Added....3-15
3.2.4 Effect on Personal Income....3-16
3.2.5 Change in Employment....3-16
3.2.6 Change in Tax Revenue....3-17
3.2.7 Summary....3-18
3.2.8 Uncertainty....3-18
4. Benefit-Cost Analysis of the Alternative Regulations 4-1
4.1 Conceptual Basis for Benefit-Cost Analysis of PWC Restrictions in National Parks....4-1
4.1.1 Social Costs of PWC Use....4-4
4.1.2 Social Benefits of PWC Use....4-9
4.2 Results for Cape Lookout National Seashore....4-12
4.2.1 Affected Groups....4-12
4.2.2 Scenarios....4-17
4.2.3 Costs....4-18
4.2.4 Benefits....4-22
4.3 Summary....4-32

5. Small Entity Impact Analysis 5-1

5.1 Identifying Small Entities 5-1

5.2 Assessment 5-3

References R-1

Appendixes

A Economic Impact Analysis A-1

B Social Benefits and Costs of Personal Watercraft Restrictions B-1

Figures

1-1 Map of CALO and Surrounding Region 1-6

4-1 Interrelationship Among Market, Environmental, and Household Systems and Social Welfare 4-2

4-2 Routes of Environmental Damages and Human Welfare Losses from PWC Use in National Parks 4-7

Tables

2-1 Monthly Recreational Visitation to CALO, 2004 2-4
2-2 Annual Recreational Visitation to CALO, 1979–2004 2-5
2-3 Summary Number of PWC and Boats on a Typical High-Use Day at CALO, 2000–2001 2-6
2-4 Projected Baseline Visitation to CALO, 2006–2015 2-9
2-5 Projected Visitation to CALO in the Absence of the Ban on PWC Use, 2006–2015 2-10

3-1 Assumptions Used in Analyzing Economic Impacts of CALO Regulatory Alternatives for PWC Use 3-6
3-2 Incremental CALO Visitation under Regulation Relative to Baseline Conditions 3-8
3-3 Spending Profiles for Visitors to National Parks (2001$) 3-10
3-4 First Year Direct Impact of PWC Regulations on Business Revenues in CALO Region Relative to Baseline (2005$) 3-13
3-5 First Year Total Impacts on Value of Output for CALO Region (2005$) 3-14
3-6 First Year Total Impacts on Value Added for CALO Region (2005$) 3-15
3-7 First Year Total Impacts on Personal Income for CALO Region (2005$) 3-16
3-8 First Year Total Change in Employment for CALO Region (number of jobs) 3-17
3-9 First Year Change in State and Local Sales Tax Revenue 3-17

4-1 Classification of Potential Negative Impacts from PWC Use in National Parks 4-5
4-2 Summary of Average Recreation Values (2005$ per Person per Day) for Selected Activities by Region 4-8
4-3 Incremental Impacts of Alternatives on User Groups 4-14

4-4 Projected Incremental Change in Consumer Surplus for PWC Users Under Alternatives A and B, 2006–2015 (2005$).....4-25
4-5 Profit Ratios Used for Calculating Producer Surplus Losses....4-29
4-6 Changes in Producer Surplus in the First Year Resulting from PWC Use Management Alternatives in CALO (2005$) 4-29
4-7 Changes in Producer Surplus Resulting from Reinstating PWC Use in CALO, 2006–2015 (2005$) 4-30
4-8 Present Value of Projected Incremental Benefits Under Alternatives A and B (in thousands of 2005$), 2006–2015.....4-33

List of Acronyms and Abbreviations

BEA	U.S. Bureau of Economic Analysis
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CALO	Cape Lookout National Seashore
D & B	Dun & Bradstreet
dB	Decibel
EA	Environmental Assessment
EFH	Essential Fish Habitat
EPA	Environmental Protection Agency
HCs	Hydrocarbons
I-O	Input-Output
MACTEC	MACTEC Engineering and Consulting, Inc.
MGM2	Money Generation Model – Version 2
MTBE	Methyl Tertiary Butyl Ether
NCER	National Center for Environmental Research
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMMA	National Marine Manufactures Association
NO_X	Nitrogen Oxides
NPS	National Park Service
O_3	Ozone
OMB	U.S. Office of Management and Budget
PAHs	Polycyclic Aromatic Hydrocarbons
PARVS	Public Area Recreation Visitors Study
PM	Particulate Matter
PM_{10}	10 µm Aerodynamic Diameter
PWC	Personal Watercraft
PWIA	Personal Watercraft Industry Association
PV	Present Value
RFA	Regulatory Flexibility Act
ROG	Reactive Organic Gases
SAFMC	Southern Atlantic Fishery Management Council
SAV	Submerged Aquatic Vegetation
SBA	Small Business Administration
SI	Spark Ignition

SIC	Standard Industrial Classification
VOCs	Volatile Organic Compounds
WDNR	Wisconsin Department of National Resources
WTP	Willingness To Pay

1 Introduction

Historically, NPS classified PWC with other water vessels, which allowed their use when the use of other vessels was permitted. More recently, NPS has reevaluated its methods of PWC regulation. This report describes the results of an economic analysis of the proposed alternatives for regulating PWC use in CALO.

Historically, the National Park Service (NPS) classified personal watercraft (PWC) with all other water vessels, which allowed people to use PWC when the use of other vessels was permitted by a Superintendent's Compendium.[1] In recognition of its duties under the Organic Act and NPS Management Policies, as well as increased awareness and public controversy, NPS reevaluated its methods of PWC regulation. Because of new information regarding potential resource impacts, conflicts with other users, and safety concerns associated with PWC use, NPS proposed a PWC-specific regulation in 1998. The regulation stipulated that PWC would be prohibited in units of the national park system unless NPS determines that PWC use is appropriate for a specific unit based on that unit's enabling legislation, resources and values, other visitor uses, and overall management objectives (63 FR 49,312–17, September 15, 1998). This report describes the results of an economic analysis of the proposed alternatives for regulating PWC use in Cape Lookout National Seashore (CALO), located along the eastern North Carolina coastline.

During a 60-day comment period, NPS received nearly 20,000 comments on this proposed regulation. As a result of public comments and further review, NPS promulgated an amended regulation in March 2000. This amended regulation allows NPS to permit PWC use in 11 units by promulgating a special regulation and in an additional 10 units by amending the Superintendent's Compendiums (36 CFR 3.24[b], 2000). The March 2000 regulation provided park units a 2-year grace period in which PWC use could continue, after which time PWC would be banned from any park that

[1] A compendium is an NPS management tool used specifically by a park superintendent to take actions to address park-specific resource protection concerns.

took no action to promulgate either PWC-specific regulations or to regulate PWC use in the Superintendent's Compendium.

On August 31, 2000, Bluewater Network et al. filed a complaint with the United States District Court for the District of Columbia against NPS alleging, among other things, that the NPS rule-making decisions to allow PWC use in some park units after 2002 by making entries in Superintendent's Compendiums would not provide the opportunity for public input. In addition, the environmental group claimed that because PWC cause water and air pollution, generate noise, and pose public safety threats, NPS acted arbitrarily and capriciously when making its September 1998 and March 2000 decisions.

A settlement agreement between NPS and Bluewater Network was signed by the District Court on April 12, 2001. The agreement requires all park units wishing to continue PWC use to promulgate special regulations only after each unit conducts an environmental analysis in accordance with the 1969 National Environmental Policy Act (NEPA). At a minimum, the NEPA analysis must evaluate the impacts of PWC on water quality, air quality, soundscapes, wildlife, wildlife habitat, shoreline vegetation, visitor conflicts, and visitor safety. NPS (2004a) contains the NEPA analysis for CALO. In addition, NPS is required by federal statutes, including Executive Order 12866, to conduct a benefit-cost analysis of the proposed regulation and analyze the impact of the regulation on small businesses under the Regulatory Flexibility Act (RFA) of 1980. This report contains the benefit-cost and RFA analyses. Based on the settlement agreement, PWC use in CALO was prohibited as of April 22, 2002. After that date, PWC use in CALO is prohibited until the final rule is published.[1]

1.1 ORGANIZATION OF REPORT

This report presents the NPS' economic analysis of the alternative CALO PWC regulations under consideration. The report is organized as follows. Section 1 describes the reason for the regulation and the current and proposed regulations at CALO. Baseline visitation, summary of the environmental conditions, and economic activity in CALO are described in Section 2. The local economic impacts on the region surrounding CALO are summarized

[1]Under the no-action alternative, PWC use would continue to be banned.

in Section 3. Section 4 describes the methodology for assessing the impacts of the alternatives on social welfare and presents a cost-benefit analysis of the regulatory alternatives. Section 5 provides an analysis of the regulatory alternatives' impacts on small businesses. In addition, Appendix A describes the principles of economic impact analysis, and Appendix B includes a detailed theoretical discussion of the types of benefits and costs associated with PWC restrictions in national parks and the methods used in their estimation.

1.2 PROBLEM ADDRESSED BY REGULATION

The U.S. Office of Management and Budget (OMB) directs regulatory agencies to demonstrate the need for their rules (OMB, 1992).

In general, regulations should be imposed only where a market failure exists that cannot be resolved efficiently by measures other than Federal regulation. The justification for restricting PWC use in national parks is based on externalities associated with their use.

In general, regulations should be imposed only where a market failure exists that cannot be resolved efficiently by measures other than Federal regulation. If each producer and consumer has complete information on his or her actions and makes decisions based on the full costs of those actions, resources will be allocated in a socially efficient manner. However, when the market's allocation of resources diverges from socially optimal values, a market failure exists. A defining feature of a market failure is the inequality between the social consequences of an action and a purely private perception of benefits and costs. The major causes of market failure identified in the OMB guidance on Executive Order 12866 are externalities, natural monopolies, market power, and inadequate or asymmetric information. For environmental problems resulting from market failures, this divergence between private and social perspectives is normally referred to as an externality. Such divergences occur when the actions of one economic entity impose costs on parties that are external to, or not accounted for in, a market transaction or activity.

The justification for restricting PWC use in national parks is based on externalities associated with their use. For instance, the operation of PWC imposes costs on society associated with noise emissions, air and water pollution emissions, and health and safety risks. Because PWC users have little incentive or lack the knowledge to consider these external costs, they are likely to make decisions about PWC use without taking these impacts on other people into account.

If these externalities are internalized to the PWC users generating them, the problem can be mitigated. For example, if PWC users were required to pay for the marginal external costs they impose on others, they would begin to take those costs into account when making decisions and the market failure would be corrected. However, accurately assigning costs associated with each individual PWC user's actions and enforcing payment is essentially not feasible at this time. Other regulatory options to address the externalities associated with PWC use are far easier to implement and enforce. Some of these options include restricting areas where they are permitted, the time of day when they can be used, and PWC engine type.

The extent to which social welfare improves due to PWC regulation depends on the relative costs and benefits associated with such restrictions. Although non-PWC users gain from PWC restrictions, the PWC users and local businesses that serve them experience welfare losses.

The extent to which social welfare improves due to PWC regulation depends on the relative costs and benefits associated with such restrictions. Although non-PWC users gain from PWC restrictions, the PWC users and local businesses that serve them experience welfare losses. Thus, the likelihood that a particular regulatory option will improve social welfare in an individual national park unit depends on numerous park-specific factors that influence the level of costs and benefits. Although a given set of restrictions on PWC use in one park may improve social welfare, the same set of restrictions in another park could easily have negative impacts on social welfare. For example, banning PWC in a park where there is little other motorized boating activity may result in large proportionate reductions in noise and emissions whereas banning PWC in a park with a high level of other motorized boating activity may not have a noticeable effect on noise or emissions levels. In the latter case, the costs to PWC users could be larger than the gains to other park visitors. Thus, it is important to consider the conditions specific to each individual park in selecting the preferred regulatory alternative for that park.

1.3 CURRENT PWC ACTIVITIES AT CALO

PWC use at CALO is currently banned in all park waters because no PWC-specific regulation was promulgated prior to the end of the grace period (April 2002) specified by the March 2000 regulation. For the purpose of the analyses provided herein, a ban on PWC use within CALO is considered the baseline condition. Prior to April 2002, CALO was closed to PWC use through the Superintendent's Compendium in March 2001. However, this closure was rescinded by the Secretary of the Interior in April 2001. Therefore from April

2001 until the ban in April 2002, PWCs were allowed in CALO under the North Carolina PWC Regulations. Section 1.4 describes the proposed regulatory alternatives considered for PWC in CALO.

Figure 1-1 shows the area within CALO borders as well as the surrounding region.

1.4 PROPOSED REGULATIONS

The following three alternatives are being considered for the management of PWC in CALO.

1.4.1 Alternative A: Reinstate PWC Use Under a Special Regulation as Previously Managed

Proposed Regulations for PWC Use in CALO

Alternative A: Reinstate PWC Use Under a Special Regulation as Previously Managed

Alternative B: Reinstate PWC Use Under a Special Regulation with Additional Management Restrictions

Alternative C: No-Action (Continue PWC Ban)

Under Alternative A, a special NPS regulation would be written to reinstate PWC use within CALO in accordance with NPS Management Policies for PWC prior to the 2002 ban and North Carolina state PWC regulations with no additional PWC restrictions.

Areas of Use

All areas under legal jurisdiction of CALO would be open to PWC use and access. This would include all waters within 150 feet from the mean low water mark on the soundside of the park. In addition, PWC would be allowed to beach on the oceanside.

State PWC Regulations

The following North Carolina PWC regulations would be enforced within Back and Core Sounds (including waters within CALO).

- No one under 12 years old can operate a PWC in North Carolina waters. A person at least 12 years old, but less than 16 years old, can operate a PWC if they are riding with a person who is at least 18 or the youth has first successfully completed an approved boating safety education course (must carry proof of age and course completion while operating PWC).
- No one can operate a PWC on state waters between sunset and sunrise. All PWC riders, passengers, and those being towed must wear approved personal flotation devices.

Figure 1-1. Map of CALO and Surrounding Region

- If the PWC is equipped with a lanyard-type engine cut off switch, the lanyard must be worn by the operator at all times.
- A PWC must have a rearview mirror or an observer on board besides the operator to legally tow someone on skis or similar device.
- PWC must be operated at all times in a reasonable and prudent manner. Maneuvers that endanger people or property constitute reckless operation.
- No person will operate a PWC on the waters of this state at greater than no-wake speed within 100 feet of an anchored or moored vessel, a dock, pier, swim float, marked swimming area, swimmers, surfers, persons engaged in angling, or any manually operated propelled vessel, unless the PWC is operating in a narrow channel.
- No person will operate a PWC in a narrow channel (a segment of the waters of the State 300 feet or less in width) at greater than no-wake speed within 50 feet of an anchored or moored vessel, a dock, pier, swim float, marked swimming area, swimmers, surfers, persons engaged in angling, or any manually operated propelled vessel.
- No person will operate a PWC towing another person on water skis or similar device unless the total number of persons operating, observing, and being towed does not exceed the number of passengers identified by the manufacturer as the maximum safe load for the vessel.
- Reckless PWC operation includes the following:
  - √ unreasonable or unnecessary weaving through congested boat traffic;
  - √ jumping the wake of a vessel within 100 feet of the vessel or when visibility is obstructed;
  - √ intentionally approaching a vessel to swerve at the last moment. Operating contrary to the “rules of the road”; and
  - √ following too closely to another vessel, including another PWC.

1.4.2 Alternative B: Reinstate PWC Use Under a Special Regulation with Additional Management Restrictions (Preferred Alternative)

Under this alternative, special use areas would be identified where PWC could access Shackleford Banks, South Core Banks, and North Core Banks. PWC use and access would be prohibited in all other areas or the national seashore and within the water 150 feet of the mean low water line on the sound-side. PWC would not be

allowed to beach on the oceanside anywhere within the park, except for special use areas that are technically defined by the state as ocean waters. Safety and operating restrictions would be dictated by the North Carolina PWC regulations outlined in Alternative A and additional NPS operating restrictions.

Special-Use Areas

Ten special-use areas would provide for PWC access within CALO boundaries. PWC would be allowed to access these areas on North Core Banks, South Core Banks (including Cape Lookout), and Shackleford Banks by remaining perpendicular to shore and operating at an idle or flat wake speed.

North Core Banks

1. Ocracoke Inlet: Wallace Channel dock to the demarcation line in Ocracoke Inlet
2. Ferry landing at Morris Kabin Kamp and Long Point Cabin area
3. Existing dock at mile post 11B approximately 4 miles north of Long Point
4. Soundside beach (as designated by signs), approximately 0.5 mile north of Old Drum inlet (adjacent to the cross-over route) encompassing approximately 50 feet

South Core Banks

5. Carly Dock at Alger Willis Fish Camps (noted as South Core Banks—Great Island on map)
6. Soundside beach (as designated by signs), approximately 0.25 mile long, beginning approximately 0.5 mile south of New Drum Inlet

Cape Lookout

7. Soundside beach 100 feet south of the “summer kitchen” to 200 feet north of the Cape Lookout Environmental Education Center Dock
8. A zone 300 feet north of the NPS dock at the lighthouse ferry dock
9. Soundside beach at Power Squadron Spit across from rock jetty to end of the Spit

Shackleford Banks

10. Soundside beach at Shackleford Banks from Whale Creek west to the Wade Shores toilet facility and from Beaufort Inlet east to the passenger ferry dock

Access and Wake Restrictions

Within these special-use areas, all PWC would be required to remain perpendicular to shore and operate at an idle speed that would result in no visible wake within park waters.

Equipment and Emissions

The Environmental Protection Agency (EPA) promulgated a rule to control exhaust emissions from new marine engines, including outboards and PWC. Emission controls provide for increasingly stricter standards beginning in model year 1999 (EPA 1996, 1997). Under this alternative, it is assumed that PWC two-stoke engines would be converted to cleaner direct-injected or four-stroke engines in accordance with EPA's assumptions (40 CFR Parts 89-91, "Air Pollution Control; Gasoline Spark-Ignition and Spark-Ignition Engines, Exemptions; Rule, 1996). CALO would not accelerate this conversion from two-stroke to four-stroke engines for PWC.

Visitor Education

CALO park staff would support the state boater education program by annually outlining state and park PWC regulations within park brochures such as the park newspaper. Park staff would educate visitors about PWC regulations in park and state waters to help them understand the differences between park regulations and PWC regulations for other local jurisdictions along the Outer Banks.

Cooperation with Local Entities

The park would work with local and state governments to encourage consistent PWC user behavior within state waters adjacent to park PWC special-use areas. The park would like to encourage the state to define a PWC use zone in state waters adjacent to CALO that would encourage flat wake and perpendicular access to the shore.

1.4.3 Alternative C: No-Action (Continue PWC Ban)

Under the no-action alternative, no unit-specific rule would be promulgated to reinstate PWC use in CALO. Therefore, PWC use would be prohibited in CALO permanently, in accordance with Bluewater Network v. Stanton, No. CV02093 (D.D.C. 2000), the settlement agreement approved by the court on April 12, 2001.

2 Baseline Description of PWC Use in Cape Lookout National Seashore

PWC use in CALO could potentially have negligible to minor impacts on water and air quality, soundscapes, wildlife and wildlife habitats, and cultural resources if PWC use is reinstated.

CALO was established by Public Law 89-336 in 1966. The mission of CALO is to conserve and preserve for the future the outstanding natural resources of a dynamic coastal barrier island system, to protect and interpret the significant cultural resources of the past and contemporary maritime history, to provide for public education and enrichment through proactive interpretation and scientific study, and to provide for sustainable use of recreation resources and opportunities. Additional legislation cited the following: to "administer the Cape Lookout National Seashore for the general purposes of public outdoor recreation, including conservation of natural features contributing to public enjoyment," and further to provide "facilities needed to accommodate the health, safety and recreation needs of the visiting public" (P.L. 93-477).

CALO is located in the central coastal area of North Carolina between Beaufort and Ocracoke Inlets. The seashore consists of three barrier islands that make up the southernmost portion of the North Carolina Outer Banks. South Core Banks, the major portion of Cape Lookout National Seashore, arcs northeastward from Cape Lookout Bight for 25 miles to Drum Inlet. Drum Inlet separates South Core Banks from North Core Banks (which extends northeastward for another 22 miles). Another island located at the southern end of the Core Banks, Shackleford Banks, is 9 miles long and has an east-west orientation with a higher dune system (because of prevailing winds) and larger areas of vegetation; Barden Inlet separates it from South Core Banks. The area of the national seashore encompasses 28,400 acres, including a 91-acre administrative site on Harker's Island.

More than one-third of the total seashore acreage comprises small, scattered islands on the soundside of Shackleford Banks and Core Banks/Portsmouth Island and in the near shore water surrounding the barrier islands. Approximately 18,400 acres of emergent land compose the barrier islands. No roads connect Core Banks to the mainland or each island with another.

These barrier islands are a dynamic system, migrating and evolving in response to coastal processes, winds, storms, and rising sea levels. Shoreline configuration and location may change dramatically in response to storms. Seashore vegetation is adapted to varying degrees of ocean overwash, fresh water availability, salt spray, and windblown sand. Vegetative adaptations have resulted in interdune meadows, shrub thickets, maritime forests, and fresh and saltwater marshes. This variety of vegetative communities provides habitat for many animal species, some dependent on specific vegetative types and others benefiting from an ability to use multiple communities. The interrelationship of seashore terrestrial and aquatic systems is complex and extensive. Hardly any terrestrial area is more than a few meters from water or wetland. The health of one system clearly affects that of the other.

Popular activities at CALO include boating, sailing, kayaking, beach recreation, fishing, shellfish harvesting, camping, hiking, wildlife viewing, commercial fishing, shell collecting, historical tourism, and off-road vehicle use.

2.1 PWC AREA ACCESS, MAINTENANCE, AND ENFORCEMENT

Although PWC use is currently banned in CALO (see Section 1.3), this section reviews PWC access, maintenance, and enforcement prior to the ban.

PWC use at CALO (including launching, operating, and beaching) is currently banned in all park waters by the NPS PWC ban that took effect on April 22, 2002. PWC use at CALO prior to the ban was very low (less than one-tenth of 1 percent annual visitation) (NPS, 2004a).

During the year 2000, the occurrence of PWC was documented during routine patrols of Cape Lookout National Seashore. PWC and boats were counted on 211 days between January 2nd and December 30th, with the highest occurrence between May and October. A total of 523 PWC and 6,140 boats were counted in the park. Twelve of the PWC were observed committing some type of legal violation. PWC use was very rare on the ocean beaches and most soundside marshes. The majority of PWC use was concentrated in two seashore areas that receive the heaviest day-use: on the soundside of South Core Banks at the Lighthouse (from the Lighthouse dock through Barden Inlet and the bight) and the soundside of Shackleford Banks from Wade Shores west to Beaufort Inlet (NPS, 2004a).

PWC use of ocean beaches is rare because of rough surf conditions in the ocean and the hazard of beaching PWC in the ocean surf. Infrequent use of the soundside marshes by PWC may be attributable to the large expanse of open water between Cape Lookout's three barrier islands and mainland North Carolina over Core Sound and the low population of the communities bordering most of North and South Core banks. However, PWC are capable of reaching North and South Core and Shackleford banks from Beaufort, Morehead City, Marshallberg, Davis, Atlantic Beach, and other small coastal mainland communities.

The popularity of the two areas where PWC are concentrated can be attributed to the excellent soundside beaches in these areas, the attraction of the Cape Lookout lighthouse, traditional use of Shackleford Banks, their proximity to major inlets, and their close proximity to the three largest coastal population centers in Carteret County: Atlantic Beach, Morehead City, and Beaufort.

Currently, facility maintenance and law enforcement activities that are associated with PWC use at CALO are incidental to other park services. CALO does not provide any facilities solely for PWC users. CALO does not enforce boating and PWC regulations from the water; NPS boats are generally used for transportation purposes only.

2.2 VISITATION DATA

Sections 3 and 4 present analyses of the economic impacts and the social benefits and costs of PWC use under alternative regulations in CALO from 2006 through 2015. To support the development of these estimates, Section 2.2 presents projections of baseline PWC and non-PWC visitation for this period and discusses the methodology used to calculate the projections. The projected baseline represents visitation to CALO after imposing the ban on PWC use. In addition, projected visitation expected to have occurred in the absence of the ban is presented.

2.2.1 Historical CALO Visitation Data

Table 2-1 presents the 2004 monthly visitation estimates for CALO. According to NPS reports, the estimated total number of recreational visitors to the CALO area in 2004 was 720,216. Between the months of May and October, which corresponds to the typical historical PWC season, CALO received 523,182 visitors (73 percent of annual visitation). As shown in Table 2-2, visitation has grown from nearly 260,000 to over 700,000 in the last decade, with considerable variability among years.

Table 2-1. Monthly Recreational Visitation to CALO, 2004

Month	Recreational Visits
January	19,883
February	33,414
March	24,998
April	30,996
May	78,493
June	91,435
July	111,403
August	82,722
September	72,845
October	86,284
November	59,058
December	28,685
Total	720,216

Source: National Park Service (NPS). 2005. "Visitation Records," <http://www.nps.gov>. As obtained in October 2005.

Table 2-2. Annual Recreational Visitation to CALO, 1979–2004

Year	Total Visitation	Year	Total Visitation
1979	50,106	1992	335,281
1980	64,959	1993	294,085
1981	51,957	1994	257,940
1982	62,653	1995	348,390
1983	68,000	1996	379,370
1984	86,279	1997	374,893
1985	100,380	1998	357,443
1986	95,575	1999	553,243
1987	88,898	2000	446,148
1988	100,444	2001	625,387
1989	232,644	2002	610,337
1990	283,074	2003	704,480
1991	320,161	2004	720,216

Source: National Park Service (NPS). 2005. "Visitation Records," <http://www.nps.gov>. As obtained in October 2005.

CALO is most commonly accessed by private boat or public ferry. Ferries depart from Harkers Island, Beaufort, Morehead City, Atlantic Beach, Davis, and Ocracoke, NC (NPS, 2004a). Vehicle ferries are operated out of Atlantic Beach and Davis, NC. However, vehicular traffic is limited because CALO has no developed roads. Driving is allowed on the open beach and marked sand trails. Vehicles are prohibited on Shackleford Banks.

CALO is located in Carteret County. A 1993 visitor use study found that approximately 80 percent of the visitors to the park were from North Carolina, with a median distance traveled of 200 miles. Over 70 percent of visitors indicated they were repeat visitors (Texas A&M, 1995).

2.2.2 Historical CALO Watercraft Visitation Data

NPS assumes that CALO's park staff has the best available data on total PWC visitation to the park.

NPS does not have data for PWC use prior to 2000. However, CALO staff collected data on PWC use during 2000 and 2001. Counts of PWC and other watercraft were collected by NPS staff at one or more of the three areas of the park: North Core Banks, South Core Banks, and Shackleford Banks. Based on these data, PWC were commonly observed at South Core Banks and

Shackleford Banks prior to the ban in 2002. North Core Banks experienced limited PWC use. Shackleford Banks was the most common destination for PWC(NPS, 2004a).

Summer holidays and weekends were the most popular times for PWC use. NPS averaged the five highest counts of the year to estimate the number of PWC on a typical high-use day in each area. Typical high-use day numbers were estimated to be approximately 33 for Shackleford Banks, 19 for South Core Banks, and 3 for North Core Banks, as shown in Table 2-3. Boat counts were also conducted, and the number of boats on high-use days in the same areas are also presented in this table.

Table 2-3. Summary Number of PWC and Boats on a Typical High-Use Day at CALO, 2000–2001

Location	PWC	Boats
Shackleford Banks	33	400
South Core Banks	19	270
North Core Banks	3	19

Source: National Park Service (NPS). 2004b. *PWC and Boat Use Numbers and Trends.* Unpublished.

Because counts of PWC were done through all seasons of the year in 2000, the total number of PWC users that visited CALO was calculated by scaling up ranger counts by the ratio of total days in 2000 (366 days) to the number of days that counts were conducted (211 days). Using this method, NPS estimates that approximately 910 PWC per year visited CALO during 2000 (NPS, 2004b). Boat counts for 2000 and 2001 were 10,600 and 11,400, respectively, suggesting that PWC make up less than 10 percent of total boat use (NPS, 2004b).

Estimates of group size for PWC users were not available for CALO. However, other parks where estimates of group size for PWC users are available include Lake Meredith National Recreation Area, Glen Canyon National Recreation Area, and Lake Mead National Recreation Area, and average group size in CALO can reasonably be assumed to be similar to these parks. The estimated group size for PWC users at these parks ranges from 3.0 to 4.5 people per PWC (MACTEC *et al.*, 2002a,b; 2003), with an average of approximately 3.5 people per PWC. Applying this average group size to CALO PWC counts implies that

approximately 3,185 people used PWC annually in CALO in 2000, or 0.71 percent of total recreational visitation.

2.2.3 Projected Visitation

METHODOLOGY FOR PROJECTING VISITATION

To project PWC and non-PWC visitation for the years 2006 through 2015, NPS used the following methodology:

Baseline

1. Calculate average recreational visitation over the five most recent years with data available (2000–2004).
2. Divide the recreational visitation estimated in Step 1 between PWC and non-PWC visitation using estimates of PWC use in 2000 relative to total recreational visits.
3. Project baseline non-PWC visitation for the period 2006–2015 by allowing non-PWC visitation to change from the 2000–2004 average based on the population growth rate for the areas from which most visitors to the park originate. The growth rate from 1992–2002 in the seven counties nearest to the park yields an average annual growth rate of 0.58 percent.
4. Assume there would be no PWC use in 2006–2015 under baseline conditions because of the current ban on PWC use in CALO.
5. Project visitation by former PWC users by assuming a certain fraction will continue to visit CALO to engage in activities other than PWC use following the ban. These percentages will typically be based on professional judgment, because of the absence of a formal study of PWC use in CALO.

Without Ban

1. Calculate average recreational visitation over the five most recent years with data available (2000–2004).
2. Divide the recreational visitation estimated with 2000-2004 data between PWC and non-PWC visitation using an estimate of 3,185 PWC users in 2000. This results in an estimate of PWC users accounting for 0.71 percent of visitation.
3. Estimate PWC visitation for 2006–2015 by using the estimates of annual growth in PWC use presented in NPS (2004b). Although the numbers of PWC owned and sold are declining nationally (National Marine Manufacturers Association [NMMA], 2002a,b), local trends are assumed

to be a better source of data for projecting PWC use than national trends because locals comprise the majority of PWC users at the park.[1] The NPS methodology estimates the annual growth in PWC visitation based on population and PWC/boat registrations in North Carolina. Based on this methodology, PWC use is assumed to increase at an annual rate of 3 percent between 2006 and 2015.

Projecting Visitation for 2006 through 2015

Following the methodology outlined above, NPS calculated CALO average annual recreational visitation for 2000–2004 to be 621,314. According to NPS estimates, approximately 0.71 percent of 2000 visitors used a PWC in CALO. Assuming that the percentage of visitors who use PWC remains constant over time, this implies an annual average of 4,197 PWC users and 617,117 non-PWC users from 2000 to 2004.

Estimates by park staff indicate that PWC use at CALO will grow at the constant rate of 3 percent per year in the absence of a ban.

As described above, NPS expects that non-PWC visitation will grow at the rate of population growth for the areas where most visitors to CALO originate. NPS believes that most visitors originate from Carteret County, which encompasses the park, and the six counties surrounding Carteret County (Onslow, Jones, Craven, Pamlico, Beaufort, and Hyde counties). In the absence of the ban, visitation by PWC users was projected assuming that PWC use will grow at a constant rate over time. According to the U.S. Bureau of Economic Analysis (BEA), population in these seven counties experienced an average growth rate of 0.58 percent annually from 1992 to 2002 (BEA, 2004). This is below the national average of 1.16 percent.

For 2006 to 2015, no baseline PWC use in the park is assumed because PWC were banned in the park as of April 22, 2002. However, many of the former PWC users who can no longer use a PWC in CALO may continue to visit the park to pursue other types of recreation. It was assumed that 50 percent of PWC users would continue to visit the CALO park region under the ban. This percentage is based on professional judgment and reflects the uniqueness of CALO. Based on the estimated regional population growth rate, the projected change in PWC ownership, and the assumed percentage of former PWC users who stop using PWC

[1] In analyses of PWC regulations in other national parks, NPS has typically relied on national data because of a lack of park-specific information. However, where local information is readily available, NPS prefers the local data because it should reflect conditions at a particular park more accurately.

in the park but who will continue to visit the park for other activities, projected baseline visitation for CALO from 2006 to 2015 is presented in Table 2-4.

Table 2-4. Projected Baseline Visitation to CALO, 2006–2015[a]

		Non-PWC Users			
Year	PWC Users	Non-PWC Users in the Absence of the Ban	Visitors that Would Have Used PWC in the Absence of the Ban[b]	Total Non-PWC Users	Total Visitation
2006	0	627,968	2,293	630,261	630,261
2007	0	631,627	2,293	633,921	633,921
2008	0	635,308	2,293	637,601	637,601
2009	0	639,010	2,293	641,304	641,304
2010	0	642,734	2,293	645,027	645,027
2011	0	646,480	2,293	648,773	648,773
2012	0	650,247	2,293	652,540	652,540
2013	0	654,036	2,293	656,329	656,329
2014	0	657,847	2,293	660,141	660,141
2015	0	661,681	2,293	663,974	663,974

[a]These projections are based on the estimated regional population growth rate, the assumed constant level of PWC use, and the assumed percentage of former PWC users who voluntarily stop using PWC in the park and who will continue to visit the park for other activities. There is no PWC use in the park after April 22, 2002, under baseline conditions, because PWC were banned on that date.

[b]This category represents visitors who would have used PWC in CALO in the absence of the ban but would continue to visit the park to engage in alternative activities following the ban. These values were calculated based on an assumption that 50 percent of those people who would have used PWC in the park in the absence of the ban would continue to visit the park to engage in alternative activities.

To estimate the incremental impacts of the alternative management strategies (see Sections 3 and 4), the change in visitation relative to these baseline conditions must be projected. Table 2-5 presents the projected visitation that would have taken place in the absence of the ban on PWC use in CALO.

Table 2-5. Projected Visitation to CALO in the Absence of the Ban on PWC Use, 2006–2015

Year	PWC Users	Non-PWC Users	Total Visitation
2006	4,586	627,968	632,554
2007	4,724	631,627	636,351
2008	4,866	635,308	640,174
2009	5,012	639,010	644,022
2010	5,162	642,734	647,896
2011	5,317	646,480	651,796
2012	5,476	650,247	655,723
2013	5,641	654,036	659,677
2014	5,810	657,847	663,657
2015	5,984	661,681	667,665

2.2.4 Sources of Uncertainty in Visitation Projections

NPS estimates of PWC and non-PWC visitation in the years 2006 through 2015 are based on a number of assumptions. In addition, a variety of unpredictable circumstances could affect visitation in a particular year. In general, visitation to CALO in a specific year will depend on many factors, including

- economic conditions,
- weather,
- natural resource conditions,
- national and state regulations that may affect PWC use or prices,
- alternative recreational activities available, and
- other infrequent events that may occur in a given year that affect visitation.

Although many of these factors are difficult to predict, a regulation enacted by EPA in 1996 may affect PWC use nationally and in CALO. The 1996 EPA rule for New Gasoline Spark-Ignition (SI) Marine Engines[1] (hereafter referred to as the 1996 EPA Marine Engine Rule) requires PWC (and other SI marine engine)

[1]In 1996, EPA promulgated a rule to control exhaust emissions from new spark-ignition (SI) marine engines, including outboards and PWC. Emission controls provide for increasingly stricter standards beginning in model year 1998, with all PWC manufactured after 2006 required to be EPA emissions-compliant (i.e., to reduce hydrocarbon [HC] emissions by 75 percent from unregulated levels) (*Federal Register*, 1996).

manufacturers to reduce emissions by 75 percent from the 1998 model year until the 2006 model year (*Federal Register*, 1996). In their analysis of the rule, EPA predicted that the emissions from all of the regulated engines in use will decrease by approximately 75 percent from baseline emission levels by the year 2025. The delay in actual emission reductions for machines in use is due to the long lives of some marine engines. EPA predicts that complete fleet turnover for some engines may not occur until 2050. However, EPA assumes that the life cycle for PWC is 10 years, considerably shorter than their assumptions for the life cycles of some of the other SI marine engines covered by the rule (*Federal Register*, 1996). According to the Personal Watercraft Industry Association (PWIA), PWC manufacturers have already reduced the emissions of PWC significantly, and many of the newer PWC models already comply with the 1996 EPA Marine Engine Rule (PWIA, 2002).

Without long term PWC use data, predicting whether NPS' assumptions will bias the projections upward or downward is difficult.

It is also possible that publicity surrounding the proposed NPS PWC rules may have affected PWC use. PWC sales have been declining nationally over the past few years. However, the sales decline began in 1996, which is before NPS first proposed rules restricting PWC in national parks. This suggests that other factors also may be involved in the recent national sales decline. Nonetheless, it is possible that baseline PWC use would have been higher in the absence of recent negative publicity.

NPS identified the following additional uncertainties in the projections of baseline visitation:

- The estimate of 2000 PWC use represents the park's best estimate of use. The number of PWC counted in 2000 was scaled up to represent the entire year. This may not accurately characterize the number of PWC used in CALO in 2000. Even if this count is accurate for 2000, PWC use in 2000 may not be representative of typical PWC use.
- In generating an estimate of the number of annual PWC users, NPS multiplied the estimate of PWC per year by an assumed group size of 3.5 people per party. To the extent that the actual average group size at CALO differs from 3.5 for PWC users, the estimate of total PWC users may be biased upward or downward.
- NPS projects growth in non-PWC visitation based on population growth in the surrounding counties. As discussed above, a number of factors could affect visitation in any one year or the trend in visitation over time.

However, NPS believes that regional population growth, which should be related to economic conditions, represents the best available proxy for change in visitation.

- NPS makes assumptions about the number of former PWC users who will return in the future under the existing ban. These assumptions represent our best estimate, but the actual percentage of former PWC users that continue to visit the park for alternative recreation activities may be higher or lower.
- The change in future PWC use is estimated using local data on population and PWC and boat registration. These measures are only an approximation for the trend in CALO PWC use.

2.3 ALTERNATE LOCATIONS FOR PWC USE NEARBY

Many local North Carolina jurisdictions have adopted supplemental or more stringent PWC regulations. North Carolina political jurisdictions that have enacted legislation curtailing PWC operations, principally by means of distance requirements or minimum age limitations, include Atlantic Beach (which is located approximately 2.5 miles west of Shackleford Banks), Brunswick County, Carolina Beach, Emerald Isle, Holden Beach, Kitty Hawk, New Hanover County, Ocean Isle, Southern Shores, Sunset Beach, and Topsail Beach (Bradley, 1999). None of these towns and counties exist within the national seashore jurisdiction. PWC use is prohibited at nearby Cape Hatteras National Seashore, which lies immediately north of CALO. PWC use is also prohibited at Fort Macon State Park, which is immediately west of Shackleford Banks across Beaufort Inlet.

2.4 OTHER MAJOR SUMMER ACTIVITIES IN CALO

Popular activities at CALO include boating, sailing, canoeing, kayaking, swimming, beach recreation, fishing, waterfowl hunting, camping, backpacking, hiking, wildlife viewing, shell collecting, historical tourism, and off-road vehicle use.

2.5 NATURAL RESOURCES AND LIKELY ECOLOGICAL IMPACTS OF PWC USE IN PARK

This section provides an assessment of the natural resources at CALO and the potential impacts to park resources under the PWC management alternatives identified in Section 1.4. NPS conducted an impairment analysis to assess the magnitude of impacts to park resources under various PWC management alternatives. Details of this analysis, including guiding regulations and policies as well as methodologies and assumptions, are described in the *Personal Watercraft Use, Environmental Assessment* (NPS, 2004a) for CALO. Conclusions based on the impact analysis for each alternative are presented below. Impacts are assessed using current conditions as baseline and comparing them with the PWC management alternatives (see Section 1). The following impact thresholds were established in the CALO Environmental Assessment (EA) to describe the relative changes in resources:

- Negligible: Impacts would not be detectable, would be well below resource standards or criteria, and would be within historical or desired water quality conditions.
- Minor: Impacts would be detectable but would be well below resource standards or criteria and within historical or desired conditions of the park.
- Moderate: Impacts would be detectable but at or below the resource standards or criteria; however, conditions would be altered on a short-term basis.
- Major: Impacts would be detectable and frequently altered from historical or baseline conditions in the park and would exceed resource standards or criteria slightly and singularly on a short-term and temporary basis.
- Impairment: Impacts would be detectable and substantially and frequently altered from historical or baseline conditions in the park and would frequently exceed resource standards or criteria on a short-term and temporary basis. The impacts would involve deterioration of the park's resources over the long term, to the point that the park's purpose could not be fulfilled.

Impacts have been assessed using current conditions (i.e., the PWC ban) as the baseline and comparing them with the conditions likely under the PWC management alternatives (see Section 1.4).

2.5.1 Water Quality

Most research on the effects of PWC use on water quality focuses on the impacts of two-stroke engines and assumes that impacts caused by these engines also apply to the PWC powered by them. The typical conventional (i.e., carbureted) two-stroke PWC engine intakes a mixture of air, gasoline, and oil into the combustion chamber; expels exhaust gases from the combustion chamber; and discharges as much as 30 percent of the unburned fuel mixture as part of the exhaust (California Air Resources Board, 1999). At common fuel consumption rates, an average 2-hour ride on a PWC may result in the discharge of 3 gallons (11.34 liters) of fuel into the water (VanMouwerik and Hagemann, 1999).

Contaminants released into the environment because of PWC use include those present in the raw fuel itself and those that are formed during its combustion. Fuel used in PWC engines contains many hydrocarbons (HCs), including volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene, and xylene (collectively referred to as BTEX) and methyl tertiary butyl ether (MTBE). Unburned PWC fuel does not contain appreciable levels of polycyclic aromatic hydrocarbons (PAHs), but several PAHs are formed as a result of its combustion (i.e., phenanthrene, pyrene, chrysene, benzo(a)pyrene, and acenapthylene) (VanMouwerik and Hagemann, 1999). Other HCs that are not present in PWC fuel but are by-products of incomplete combustion include formaldehyde, acetaldehyde, diesel particulate matter (PM), and 1,3-butadiene (EPA, 1994).

Unburned fuel and combustion by-products are released to the environment in PWC exhaust. Because of differences in chemical and physical characteristics, BTEX released into the water readily transfers from water to air, whereas most PAHs and MTBE do not. Therefore, water quality issues associated with BTEX in the water column are less critical than those associated with PAHs and MTBE (VanMouwerik and Hagemann, 1999).

Compounds released in water because of PWC use are known to cause adverse health effects to humans and aquatic organisms. Exhaust emissions from two-stroke engines have been shown to cause toxicological effects in fish (Tjarnlund *et al.*, 1995, 1996;

Oris *et al.*, 1998). Sunlight can further increase the toxic effect of PAHs to aquatic organisms (Mekenyan *et al.*, 1994; Arfsten, Schaeffer, and Mulveny, 1996). Research evaluating the possible phototoxic effects of some PAHs to aquatic organisms (National Center for Environmental Research [CER], 1999) has demonstrated that toxicity may vary due to a number of factors, including length of exposure; turbidity, humic acid, and organic carbon levels; the location of the organism relative to the surface of the water or the sediment; and weather/PAH fate issues (National Center for Environmental Research, 1999). For instance, while increased turbidity or organic carbon tended to reduce toxicity, increasing the length of exposure and proximity to the surface (i.e., shallow waters) tended to increase toxicity.

New PWC engines, including direct injection two-stroke engines and four-stroke engines, will decrease the amount of unburned fuel that escapes with PWC exhaust and will result in decreases in emissions (VanMouwerik and Hagemann, 1999). As a result of EPA's 1996 rule requiring cleaner running SI marine engines,[1] a 50 percent reduction of current HC emissions from these engines is expected by 2020, and a 75 percent reduction in HC emissions is expected by 2025 (*Federal Register*, 1996).

Baseline Water Quality Conditions at CALO

Core Sound is classified by the North Carolina Department of Environment and Natural Resources, Division of Water Quality as High Quality Waters, a classification intended to protect waters with quality higher than state water quality standards. There are associated wastewater treatment and development controls for High Quality Waters enforced by the state. Core Sound is also designated as Outstanding Resource Waters, a classification intended to protect unique and special waters having excellent water quality and being of exceptional state or national ecological or recreational significance. No new or expanded wastewater discharges are allowed into Outstanding Resource Waters and

[1] In 1996, EPA promulgated a rule to control exhaust emissions from new SI marine engines, including outboards and PWC. Emission controls provide for increasingly stricter standards beginning in model year 1998, with all PWC manufactured after 2006 required to be EPA emissions compliant (i.e., to reduce HC emissions by 75 percent from unregulated levels) (*Federal Register*, 1996).

there are associated watershed stormwater controls enforced by the state (NPS, 2004a).

Because the islands of CALO are a mile or more from the mainland and are undeveloped, the water quality has not been significantly affected by human activities. The primary pollution sources include mainland urban stormwater and agricultural runoff, effluent from sewage treatment plants and septic systems, recreational boating and marinas, and commercial shipping. Because of the proximity to the Intracoastal Waterway, Morehead City, and Beaufort, waters in and around the park experience considerable ship and boat traffic.

Waters in Back and Core sounds adjacent to Cape Lookout National Seashore are classified by North Carolina as having suitable water quality for shellfish harvesting. Atlantic Ocean waters adjacent to the national seashore are state classified as being suitable for recreation and aquatic life propagation. No waters surrounding Cape Lookout are under a fish consumption advisory, with the exception of the "no consumption" mercury advisory for large king mackerel along the southeast Atlantic coast.

Because PWC are currently banned from the park, their use does not have any current impact on water quality.

Potential Impact of PWC Use on Water Quality Under the Proposed Alternatives

Currently, PWC use in CALO is banned. Therefore, there are no baseline impacts of PWC on water and air quality, soundscapes, wildlife and wildlife habitat, and shoreline vegetation.

Alternative A—Reinstate PWC Use Under A Special Regulation as Previously Managed Prior to April 2002. As described in the CALO Environmental Assessment (EA) (NPS, 2004a), reinstating PWC use would have negligible adverse impacts on water quality based on ecotoxicological criteria and human health criteria from organic pollutants. By 2013, all PWC-specific water quality impacts are predicted to be negligible. On a cumulative basis, this alternative is predicted to have negligible impacts from organic pollutants, assuming 2003 conditions, and ecotoxicological impacts are predicted to be negligible. Gradual improvements to water quality from reduced emissions are likely to occur as manufacturers meet EPA requirements to improve the efficiency of engines by the year 2006 and conventional engines are replaced with direct-injected two-stroke or four-stroke models.

In 2013, all water quality impacts from motorized craft (including PWC) are expected to be lower than in 2003 because of reduced emission rates and the ban on MTBE in gasoline in 2004. NPS concludes that Alternative A would not result in impairment of water quality.

Alternative B—Reinstate PWC Use as Previously Managed Prior to April 2002 Under a Special Regulation with Additional Management Prescriptions (Preferred Alternative). As described in the CALO EA (NPS, 2004a), reinstating PWC use would have negligible adverse impacts on water quality based on ecotoxicological criteria and human health criteria. Overall, water quality impacts due to PWC emissions of organic pollutants in both 2003 and 2013 would be negligible. NPS concludes that Alternative B would not result in impairment of water quality.

Alternative C—No-Action (Continue PWC Ban). No impacts to water quality from PWC would occur within CALO if the ban continued.

2.5.2 Air Quality

Air quality and visibility can be affected by emissions from two-stroke engines such as PWC motors. Emissions from PWC in national parks are one of many potential (albeit, relatively small) sources of these air quality and visibility impairments.

Recreational marine engines, including PWC and outboard motors, contribute approximately 30 percent of national non-road engine emissions and are the second largest source of non-road engine HC emissions nationally (*Federal Register*, 1996). According to the results of a 1990 inventory of emissions in California, watercraft engines were estimated to account for 141 tons of smog-forming reactive organic gases (ROG), 1,063 tons of carbon monoxide (CO), and 31 tons of nitrogen oxides (NO_X) emitted per day (Kado *et al.*, 2000). A study comparing emissions from conventional and direct-injected two-stroke engines with four-stroke engines found that the new four-stroke engine has considerably lower emissions of PM, PAHs, and substances with genotoxic activity (Kado *et al.*, 2000). Based on a comparison with a typical 90-horsepower engine it is estimated the ban of conventional two-stroke engines would result in a four-fold

decrease in smog-forming pollution per engine (VanMouwerik and Hagemann, 1999).

Up to one-third of the fuel delivered to conventional two-stroke engines goes unburned and is discharged as gaseous HCs.

Although PWC engine exhaust is usually routed below the waterline, a portion of the exhaust gases is released to the air and may affect air quality. Up to one-third of the fuel delivered to conventional two-stroke engines goes unburned and is discharged as gaseous HCs; the lubricating oil is used once and is expelled as part of the exhaust; and the combustion process results in emissions of air pollutants such as BTEX, MTBE, PAHs, NO_X, PM, and CO (Kado *et al.*, 2000). PWC also contribute to the formation of ozone (O_3) in the atmosphere, which is formed when HCs react with NO_X in the presence of sunlight (EPA, 1993). (See Section 2.5.1 for further discussion of burned and unburned constituents of PWC emissions.) These compounds are known to cause adverse health effects to both human and plants. They may adversely affect park visitor and employee health, as well as sensitive park resources.

Ozone (O_3)causes respiratory problems in humans, including coughing, airway irritation, and chest pain during inhalation. O_3 is also toxic to sensitive species of vegetation. It causes visible foliar injury, decreases plant growth, and increases plant susceptibility to insects and disease (EPA, 1993).

Carbon monoxide can interfere with the oxygen-carrying capacity of blood, resulting in lower delivery of oxygen to tissues. NO_X and PM emissions associated with PWC use can also degrade visibility. Adverse health effects have been associated with airborne PM, especially less than 10 µm aerodynamic diameter (PM_{10}) (Kado *et al.*, 2000). NO_X also contributes to acid deposition effects on plants, water, and soil.

Baseline Air Quality Conditions at CALO

There are no monitoring stations near CALO that provide representative ambient air data. Monitoring in the state occurs principally in the more densely populated areas. Concentrations of the criteria pollutants at CALO are well below standards based on review of monitoring data for inland eastern North Carolina and the absence of monitors in the coastal area (NPS, 2004a).

The recreation area is designated a Federal Class II air quality area. Because PWC are currently banned at CALO, they have no impact on air quality.

Potential Impact of PWC Use on Air Quality Under the Proposed Alternatives

Alternative A—Reinstate PWC Use Under A Special Regulation as Previously Managed Prior to April 2002. As described in the CALO EA (NPS, 2004a), this alternative would have negligible adverse impacts on human health related to the PWC airborne pollutants CO, PM_{10}, HC, and NO_X for the year 2003. The risk from PAHs would also be negligible. In 2013, there would be increases in CO, PM_{10}, HC, and NO_X emissions, and the impact level for these pollutants would remain negligible, the same as in 2003. Overall, this alternative would have negligible adverse impacts on existing air quality condition, with future reductions in PM_{10} and HC emissions due to improved emissions controls. Overall, PWC emissions of HC are estimated to be less than 1 percent of the cumulative boating emissions in 2003 and 2013. Implementation of this alternative would not result in an impairment of air quality or air quality-related values.

Alternative B—Reinstate PWC Use as Previously Managed Prior to April 2002 Under a Special Regulation with Additional Management Prescriptions (Preferred Alternative). As described in the CALO EA (NPS, 2004a), this alternative would result in negligible air quality impacts on human health from PWC emissions, similar to Alternative A. The additional management prescriptions would slightly reduce PWC emissions as compared to Alternative A. Overall, this alternative would have negligible adverse impacts on existing air quality condition, with future reductions in PM_{10} and HC emissions due to improved emissions controls. Overall, PWC emissions of HC are estimated to be less than 5 percent of the cumulative boating emissions in 2003 and 2013. Implementation of this alternative would not result in an impairment of air quality or air quality-related values.

Alternative C—No-Action (Continue PWC Ban). No impacts to air quality or air quality-related values from PWC would occur within CALO if the ban continued.

2.5.3 Soundscapes

NPS has established a noise limit of 82 decibel (dB) at 82 feet (NPS, 2004a). Noise from PWC may be more disturbing than noise from a constant source at 90 dB because of rapid changes in acceleration and direction of noise (EPA, 1974) and their ability to be driven in shallow water close to the shoreline. However, the newer, compliant models of PWC may be up to 50 to 70 percent quieter than the older models (PWIA, 2002).

Baseline Soundscape Conditions at CALO

Natural sounds generally include sounds such as wind through trees and calling birds, while natural quiet includes the sounds associated with still nights. "Noise" is defined as unwanted sound that interferes with an activity or disturbs the person hearing it.

One aspect of experiencing CALO's resources is the ability to hear the sounds associated with its natural resources, often referred to as "natural sounds" or "natural quiet," Natural sounds generally include the naturally occurring sounds of winds in the trees, calling birds, and the quiet associated with still nights. "Noise" is defined as unwanted sound. Sounds are described as noise if they interfere with an activity or disturb the person hearing them.

Typical sounds at CALO include surf, winds blowing across water, bird calls, visitors talking, motorboats, commercial vessels, background noise from the town of Beaufort, and small aircraft. Most watercraft activity within CALO involves small to medium-sized recreational and commercial vessels used as transportation or fishing platforms. Because PWC are currently banned at CALO, they have no impact on the natural soundscape.

Potential Impact of PWC Use on Soundscape Under the Proposed Alternatives

Alternative A—Reinstate PWC Use Under A Special Regulation as Previously Managed Prior to April 2002. As described in the CALO EA (NPS, 2004a), impacts from reinstating PWC use throughout the national seashore would be adverse, short-term, and negligible to moderate. Impacts would be negligible where use is infrequent and where visitation is low and moderate in more congested areas. Although reinstating PWC use would add an additional noise source to the national seashore's soundscapes, cumulative impacts would remain adverse, short-term, and negligible to moderate given the historically low numbers of PWC use and the high numbers of

motorized boats. NPS anticipates that this alternative would not result in an impairment of the soundscape at CALO.

Alternative B—Reinstate PWC Use as Previously Managed Prior to April 2002 Under a Special Regulation with Additional Management Prescriptions (Preferred Alternative). As described in the CALO EA (NPS, 2004a), PWC would be permitted in areas historically preferred by PWC users under this alternative, but only at flat-wake speed, resulting in adverse, short-term, and negligible to minor impacts, depending on location. Cumulative impacts would be adverse, short-term, and negligible to minor impacts, depending on location. NPS anticipates that this alternative would not result in an impairment of the soundscape at CALO.

Alternative C—No-Action (Continue PWC Ban). No impacts to soundscapes from PWC would occur within CALO if the ban continued.

2.5.4 Wildlife and Wildlife Habitat

PWC may adversely affect wildlife by interrupting normal activities, inducing alarm or flight responses, causing animals to avoid habitat, and potentially affecting reproductive success.

PWC may affect wildlife by interrupting normal activities, inducing alarm or flight responses, causing animals to avoid habitat, and potentially affecting reproductive success (NPS, 2004a). These effects are thought to be caused by a combination of PWC speed, noise, and ability to access sensitive areas, especially in shallow water (Wisconsin Department of National Resources, 2000). PWC potentially can access sensitive shorelines and disrupt riparian habitats critical to wildlife. When run in very shallow water, PWC can disturb the substrate, including aquatic plants and benthic invertebrates. At certain times of the year, PWC may also affect fish breeding and nursery areas. Furthermore, water quality degradation caused by PWC can affect migratory avian species in the area (NPS, 2004a).

Waterfowl and nesting birds may be particularly sensitive to PWC because of their noise, speed, and unique ability to access shallow water. This may force nesting birds to abandon eggs during crucial embryo development stages; keep adults away from nestlings, thereby preventing them from defending the nest against predators; and flush other waterfowl from habitat, causing stress and associated behavior changes (Wisconsin Department

of Natural Resources [WDNR], 2000; Burger, 1998; Rodgers and Smith, 1997).

Baseline Wildlife and Wildlife Habitat Conditions at CALO

Because PWC are currently banned at CALO, they have no impact on wildlife or wildlife habitat.

Aquatic Wildlife. CALO contains aquatic habitats such as tidal flats, sheltered coves, salt marshes, and seagrass beds that provide food and shelter for fish, shellfish, and other aquatic wildlife. Aquatic species discussed below include those that are present in the jurisdictional waters of CALO.

A wide variety of marine mammals occur in the waters off of North Carolina's Outer Banks, including toothed and baleen whales, porpoises, dolphins, and seals. Because the waters of Back and Core sounds are very shallow (waters in the park's jurisdiction are less than 10 feet deep), few marine mammal species venture into these waters. Bottlenose dolphins are commonly found in the sounds, while harbor seals, hooded seals, and manatees are occasionally reported. Bottlenose dolphins are the most common marine mammal in the coastal and estuarine waters near CALO (NPS, 2004a).

Terrestrial Mammals. Upland animal species are somewhat limited in number on barrier islands because of the lack of diversity in vegetation and difficulty of access from mainland areas. The only large animals present in the national seashore are the feral horses on Shackleford Banks. Shackleford Banks is home to 110 to 130 feral horses, which are protected and maintained according to the park's federal legislation (NPS, 2004a).

Common smaller native species found in the national seashore include marsh rice rats, river otters, and raccoons. Shackleford Banks also has Virginia opossum, eastern mole, marsh rabbit, eastern cottontail, and muskrat. Both the South and North Core banks are home to the least shrew, while the South Core Banks support the northern short-tailed shrew and the North Core Banks the eastern cottontail (NPS, 2004a).

In addition to the common mammals listed above, the following nonnative species are also present within the national seashore: nutria, house cat, house mouse, and the Norway rat (NPS, 2004a).

Amphibians and Reptiles. Even though the harsh environment precludes large numbers and diversity of species, other animals found on the islands include amphibians and reptiles such as tree frogs, toads, turtles, and snakes (NPS, 2001).

Aquatic Invertebrates and Fish. The marine and estuarine waters of CALO contain a wide variety of fish and shellfish. The park has little data on the species of fish known to occur at CALO, but the following species have been documented: ladyfish, American eel, Atlantic menhaden, sheepshead minnow, marsh killifish, mummichog, spotfin killifish, striped killifish, rainwater killifish, western mosquitofish, inland silversides, Atlantic silversides, striped mullet, basking shark, Atlantic flying fish, bonnethead shark, blueback herring, hickory shad, alewife, American shad, gizzard shad, eastern mosquitofish, striped bass, spot, grass pickerel, and longnose gar. Fish commonly targeted by commercial and recreational fishermen in inshore waters around CALO include Spanish mackerel, king mackerel, speckled trout, weakfish, jack, bluefish, cobia, tarpon, striped bass, kingfish, black sea bass, red drum, black drum, croaker, gray snapper, summer flounder, and mullet. Shellfish of economic significance include the hard clam, oyster, bay scallop, shrimp, and blue crab (NPS, 2004a).

In addition, Essential Fish Habitat (EFH) is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 U.S.C. 1802(10)). At CALO, EFH for red drum includes estuarine emergent vegetated wetlands (flooded salt marshes, brackish marshes, and tidal creeks), submerged aquatic vegetation, oyster reefs and shell banks, unconsolidated sediments, and high salinity surf zones (Southern Atlantic Fishery Management Council [SAFMC], 1998). For shrimp, EFH in the CALO area includes inshore nursery areas including salt marshes and seagrass beds, sub tidal and intertidal non-vegetated flats, and all water bodies connecting these areas with offshore marine habitats used for spawning and growth to maturity (SAFMC, 1998). EFH areas that meet the criteria for

habitat areas of particular concern for shrimp (brown, pink, and white shrimp) include all coastal inlets, all state-designated nursery habitats (see below), and overwintering areas (NPS, 2004a).

Birds. CALO has nearly 275 species of birds that use the islands for resting, nesting, and feeding and as wintering or migratory rest-stops, and it is designated as a Globally Important Bird Area by the American Bird Conservancy. These birds include songbirds, waterfowl, wading birds, birds of prey, marine birds, and shorebirds. The northern gannet, willet, sanderling, piping plover, great black-backed gull, royal tern, common nighthawk, great blue heron, red-winged blackbird, eastern meadowlark, and song sparrow are just a few of the birds that inhabit the national seashore. The abundance and variety of birds is due to the seashore's location on the Atlantic Flyway and to the lack of development and human disturbance. The ring-necked pheasant, which is a favorite with some hunters, is an exotic species that exists in the shrub thickets on Core Banks (NPS, 2004a).

Potential Impact of PWC Use on Wildlife Habitat Under the Proposed Alternatives

Alternative A—Reinstate PWC Use Under A Special Regulation as Previously Managed Prior to April 2002. As described in the CALO EA (NPS, 2004a), reinstating PWC used in park waters would be expected to have short-term, minor, direct and indirect adverse impacts on terrestrial and aquatic wildlife species and habitats. PWC use in the vicinity of Shackleford Banks and South Core Banks at the lighthouse, where both PWC use and general visitor use is highest, would have minor, short-term, adverse effects on terrestrial wildlife, such as shorebirds, using the landing area and adjacent areas and other species such as fish that use near shore habitats to forage for food. Effects would be minor because species sensitive to a high level of noise and human activity are not expected to regularly use the landing area or immediately adjacent habitats during periods of high human use. The intensity of PWC use near the North and South Core banks from Portsmouth Village to the lighthouse would be much less than near Shackleford Banks and the lighthouse. Cumulative impacts associated with an increase in all types of motorized watercraft use are expected to be short term, minor,

direct and indirect, and adverse. This alternative would not result in an impairment of wildlife or wildlife habitat.

Alternative B—Reinstate PWC Use as Previously Managed Prior to April 2002 Under a Special Regulation with Additional Management Prescriptions (Preferred Alternative). As described in the CALO EA (NPS, 2004a), this alternative would minimize potential adverse impacts of PWC use in the 10 designated special-use areas to negligible to minor, short-term, adverse impacts. The no-wake requirements would reduce the level of PWC disturbance in the restricted areas and in nearby marshes. Reinstating PWC use in park waters and restricting their operation to a flat-wake perpendicular approach to the shoreline in designated access areas is expected to have short-term, negligible to minor, direct and indirect adverse impacts on terrestrial and aquatic wildlife species and habitats. This alternative would not result in an impairment of wildlife or wildlife habitat.

Alternative C—No-Action (Continue PWC Ban). No impacts to wildlife or wildlife habitat from PWC would occur within CALO if the ban continued.

2.5.5 Threatened, Endangered, and Special Concern Species

PWC may affect threatened, endangered, and special species of concern in the same manner they affect wildlife such as by disrupting or degrading the quality of habitat, interrupting normal activities, inducing alarm or flight responses, causing animals to avoid habitat, and potentially affecting reproductive success.

Current Conditions of Threatened, Endangered, and Special Concern Species at CALO

Federally protected species that occur at CALO and in the waters surrounding CALO include marine mammals (northern right whale, humpback whale, Florida manatee); aquatic reptiles (green sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, Atlantic loggerhead sea turtle, and American alligator); terrestrial reptiles (Carolina diamondback terrapin, Carolina water snake, and Outer Banks king snake); and special concern birds (roseate tern, American bald eagle, piping plover, peregrine falcon, gull-billed

tern, black skimmer, brown pelican, common tern, glossy ibis, least tern, little blue heron, loggerhead shrike, snowy egret, and tri-colored heron); and one plant (seabeach amaranth).

Baseline Conditions of Threatened, Endangered, and Special Concern Species at CALO

Because PWC are currently banned at CALO, they have no impact on protected species.

POTENTIAL IMPACT OF PWC USE ON THREATENED AND ENDANGERED SPECIES UNDER THE PROPOSED ALTERNATIVES

Alternative A—Reinstate PWC Use Under A Special Regulation as Previously Managed Prior to April 2002. As described in the CALO EA (NPS, 2004a), reinstating PWC use within CALO may affect but is not likely to adversely affect manatees or whales in park waters, because these species are not present in areas or during seasons of peak PWC use. PWC and other motorized vessel use may affect but is not likely to adversely affect sea turtles, Carolina diamondback terrapins, or special concern birds because of the slow vessel speeds and short trip lengths. This alternative would not result in an impairment of any listed species at CALO.

Alternative B—Reinstate PWC Use as Previously Managed Prior to April 2002 Under a Special Regulation with Additional Management Prescriptions (Preferred Alternative). As described in the CALO EA (NPS, 2004a), reinstating PWC use in park waters and restricting their operation to a flat-wake perpendicular approach to the shoreline in designated access areas may affect but is not likely to adversely affect manatees or whales in park waters, because these species are not present in areas or during seasons of peak PWC use, PWC and other motorized vessel use may affect but is not likely to adversely affect sea turtles or Carolina diamondback terrapins because of the slow vessel speeds and short trip lengths. This alternative would not result in an impairment of any listed species at CALO.

Alternative C—No-Action (Continue PWC Ban). No impacts to protected species from PWC would occur within CALO if the ban continued.

2.5.6 Shorelines and Shoreline Vegetation

PWC use may potentially adversely affect shoreline habitat, including the shoreline, shoreline vegetation, and submerged aquatic vegetation (SAV) beds. Shoreline and shoreline vegetation provide critical habitat for the juvenile stages of fish, as well as aquatic invertebrates, shell fish, waterfowl, and other fish life stages. SAV beds are also critical to aquatic organisms because they reduce wave action, support nursery fish, provide protection from predators, stabilize sediment, and provide food for many species.

PWC can access areas where most other watercraft cannot go because of their shallow draft and thus may affect shoreline and shoreline vegetation. PWC may land on the shoreline, allowing visitors to access and disturb areas where sensitive plant species exist. In addition, wakes created by PWC may cause erosion. Turbulence from boat propellers near the shoreline can also erode the shoreline by destabilizing the bottom (WDNR, 2000).

PWC use can also affect SAV by increasing turbidity, which may result in decreased sunlight available for SAV, may limit vegetation growth, and ultimately decrease water quality. PWC use in shallow water supporting SAV may reduce its value as important habitat for animals, by redistributing the plants and organisms that use these grasses for habitat.

Baseline Condition of Shorelines and Shoreline Vegetation at CALO

The barrier islands that comprise the North Core and South Core banks support a variety of vegetation ranging from salt marsh grasses to shrubs and trees. Vegetation forms distinctive ecological zones across the barrier islands (NPS, 2004a).

The beaches are void of vegetation except algae. Tidal flats contain a few stands of cordgrass at inlets. Woodlands exist on higher and protected lands and are populated by live oak and southern red cedar. American holly forms maritime forests, the

most extensive of which is located on Shackelford Banks. Also, wax myrtle, yaupon, live oak, and marsh elder form shrub thickets.

There are two types of grasslands, open grasslands and closed grasslands. Open grasslands contain salt meadow cordgrass and pennywort sparsely growing through sand deposited in overwash areas. Closed grasslands are dominated by denser stands of salt meadow cordgrass, pennywort, broomsedge, and hairgrass. Rushes grow in areas with a higher water table.

Subtidal marine vegetation also exists in the national seashore. It consists of extensive stands of eelgrass and widgeon grass, which can be found in protected, shallow waters. In Back and Core sounds, seagrass beds are dominated by eelgrass, shoal grass, and widgeon grass, a mixture of species found only in North Carolina.

Because PWC are currently banned at CALO, they have no impact on shorelines or shoreline vegetation.

POTENTIAL IMPACT OF PWC USE ON SHORELINE AND SHORELINE VEGETATION UNDER THE PROPOSED ALTERNATIVES

Alternative A—Reinstate PWC Use Under A Special Regulation as Previously Managed Prior to April 2002. As described in the CALO EA (NPS, 2004a), impacts on shoreline vegetation from foot traffic associated with PWC access to beach areas and to marsh habitats from PWC use in affected areas and limited access to marshes and other shallow water habitats would be short term, indirect, and minor because of low levels of PWC use in affected areas and limited access to marshes and other shallow water habitats. Reinstating PWC use at CALO would have impacts on SAV beds that are direct and indirect, negligible to minor, and short and long term. Cumulative impacts on shoreline vegetation and SAV habitats by all motorized vehicles would be minor. Implementation of this alternative would not result in an impairment of shoreline vegetation and SAV beds (NPS, 2004a).

Alternative B—Reinstate PWC Use as Previously Managed Prior to April 2002 Under a Special Regulation with Additional

Management Prescriptions (Preferred Alternative). As described in the CALO EA (NPS, 2004a), reinstating PWC use in park waters and restricting their operation to a flat-wake perpendicular approach to the shoreline in designated access areas is expected to have negligible, indirect, short-term impacts on SAV beds and negligible to minor short-term impacts on shoreline vegetation. Non-PWC would still be able to access SAV beds under this alternative and would be responsible for nearly all of the cumulative motorized vehicle impacts on SAV beds. Motorized vehicles, including PWC, are expected to have minor, direct and indirect, short- and long-term cumulative impacts on shoreline vegetation and SAV beds. Implementation of this alternative would not result in an impairment of shoreline vegetation and SAV beds (NPS, 2004a).

Alternative C—No-Action (Continue PWC Ban). No impacts to shorelines or shoreline vegetation from PWC would occur within CALO if the ban continued.

2.5.7 Cultural Resources

CALO has 36 recorded archaeological sites. These sites are difficult to monitor and protect because of the changing landscape of the barrier islands (NPS, 2000b]). Shell middens have been found on the island in the past, but most have been washed away by storms (NPS, 1984). None of the aboriginal sites currently known to exist within CALO were believed to be culturally and scientifically significant enough to justify their nomination to the National Historic Register (NPS, 1978).

Of the 36 recorded archaeological sites, some could be adversely affected by PWC use at CALO. The majority of the sites exist on the soundside of Shackleford Banks, primarily in the salt marshes. Some are located on small, marshy islands adjacent to Shackleford. Little evidence of these sites remains because of advanced stages of erosion and other environmental factors. According to park staff, looting and vandalism of cultural resources is not a substantial problem (NPS, 2004a).

BASELINE CONDITION OF CULTURAL RESOURCES AT CALO

Because PWC are currently banned at CALO, they have no impact on cultural resources.

POTENTIAL IMPACT OF PWC USE ON CULTURAL RESOURCES UNDER THE PROPOSED ALTERNATIVES

Alternative A—Reinstate PWC Use Under A Special Regulation as Previously Managed Prior to April 2002. As described in the CALO EA (NPS, 2004a), reinstating PWC use is not expected to substantially affect the overall condition of archaeological resources, resulting in adverse, long-term, negligible impacts. Cumulative impacts resulting from vandalism, illegal collecting, wave action from boats, and wild horses would be adverse, long term, and negligible. Implementation of this alternative would not result in an impairment of cultural resources.

Alternative B—Reinstate PWC Use as Previously Managed Prior to April 2002 Under a Special Regulation with Additional Management Prescriptions (Preferred Alternative). As described in the CALO EA (NPS, 2004a), restricting areas of use and requiring PWC to operate perpendicular to the shore and at flat-wake speed within the national seashore's jurisdiction would minimize impacts on archaeological resources from wave action. Restricting areas of use would also minimize impacts resulting from vandalism and illegal collecting. Cumulative impacts would be adverse, long term, and negligible. Implementation of this alternative would not result in an impairment of cultural resources.

Alternative C—No-Action (Continue PWC Ban). No impacts to cultural resources from PWC would occur within CALO if the ban continued.

2.6 ECONOMIC ACTIVITY IN THE SURROUNDING COMMUNITIES

Because of the small contribution of PWC users to local economic activity and the availability of substitutes, the economic impacts of reinstating PWC use at CALO are likely to be very limited.

In CALO the visitor's center and Shell Point on Harkers Island are the only areas of the park that are accessible by road. The rest of the park consists of islands off the coast. Cities and towns located in the CALO area include Morehead City and Beaufort, both of which are located less than 25 miles from the visitor's center on Harkers Island. New Bern, a slightly larger town, is located about 60 miles from the visitor's center. Northern Carteret County is very rural, with much of the area made up by marsh and open water. The southern portion of the county is more populated and

contains Beaufort and Morehead City, along with popular beach destinations such as Emerald Isle and Atlantic Beach.

Retail trade is the largest sector of Carteret County's economy, followed by manufacturing, wholesale trade, accommodation and food services, health care, and real estate rental and leasing (Census Bureau, 2002). Tourism is an extremely important part of the local economy. However, PWC use in CALO makes only a small contribution to tourism-related revenues in the regional economy. NPS estimates that PWC users make up approximately 0.71 percent of total visitation. NPS identified one PWC rental shop and four PWC sales/service shops located in communities near CALO. The PWC rental shop is located in the Salter Path/Indian Beach area. Two of the identified PWC sales shops are located in Morehead City, and two are located in New Bern. NPS collected interview data from these businesses during October and November of 2002.

Based on comments received from these businesses, Shackleford Banks of CALO was a popular destination for PWC use prior to the ban in 2002, but most PWC users visited other destinations in the area outside of CALO as well. PWC are sold year-round with the majority of the sales in the late spring/early summer. Interview data suggest that the PWC dealerships near CALO have other sources of revenue besides PWC sales, while the service center and rental shop identified by NPS rely mainly on PWC. Some of the PWC dealerships sold items such as motorcycles, boats (other than PWC), motor scooters, all-terrain vehicles, trailers, generators, and outboard motors. Each firm contacted implied that their business would be affected under at least one of the alternatives that allow PWC usage in CALO. One of the PWC sales shops reported a sharp decline in sales in the years following the ban and attributed a large part of this decline to the ban on PWC in CALO and the negative publicity surrounding the ban. Other shop owners suggested that some decline in sales or rentals may occur in the future because of the ban, but the presence of alternative locations may have mitigated the impact.

In addition to the businesses contacted, the changes in PWC management could also affect lodging establishments, restaurants, gas stations, and other retail stores in the area. These establishments may be affected if changes in PWC

management lead to changes in visitation to the park and surrounding area. However, because PWC users account for a very small fraction of economic activity in the region, it is very unlikely that there will be any measurable incremental impacts on the region's economy. The estimated regional economic impacts are discussed in more detail in Section 3.

3 Economic Impact Analysis of Reinstating PWC Use in Cape Lookout National Seashore

Reinstating PWC use in CALO may affect the local economy in several ways, including changes in park visitation, sales and profits of local businesses, local employment, and local and state sales tax revenue. Generally, allowing PWC use in the park is expected to increase economic activity in the areas surrounding the park. However, the incremental impacts under Alternatives A and B are expected to be small relative to the size of the local economy.

Historically the percentage of total visitors to CALO that used PWC has been small. Prior to the April 2002 ban, it is estimated that about 0.71 percent of visitors used PWC in the park (see Section 2.2.2). Because PWC use was not necessarily their primary reason for visiting CALO, many former PWC users are likely to have continued visiting the park under the ban. However, those park visitors who had previously used PWC in CALO are negatively affected by the current ban on PWC use in CALO. These visitors also potentially would be affected positively by any change in PWC regulations in CALO that reinstated PWC use in the park. Not only are PWC users potentially affected by any change in PWC regulations, but businesses, including PWC sales and rental shops, restaurants, and other establishments that provide services to those visitors may be affected as well.

A variety of economic analyses can be conducted to provide valuable information for policy makers trying to understand the effects of alternative policies. The type of analysis that is most appropriate for examining a particular policy or action depends on the decision under consideration. In the context of examining the impacts of regulation, two of the most important types of economic analysis are economic impact analysis and benefit-cost analysis. These types of analyses are often confused because they both

estimate the economic "benefits" associated with a particular policy. However, an economic impact analysis typically examines the effect of a change in policy on the economy of a particular region, while a benefit-cost analysis focuses on the change in economic efficiency resulting from a change in policy. Economic impact analyses trace the flows of spending associated with the affected industries to identify changes in sales, income, jobs, and tax revenues resulting from a policy action. The economic impact analysis associated with the management of PWC for CALO is addressed in this section. Benefit-cost analysis, on the other hand, focuses primarily on changes in social welfare, and is examined in Section 4. Unlike economic impact analysis studies, benefit-cost analysis includes both market and non-market values (Stynes, 2000).

Reinstating PWC use in CALO is likely to have a positive economic impact on the surrounding area. The primary economic impacts associated with the PWC management alternatives are the potential increases in sales, profits, and employment of PWC rental and sales establishments, hotels, restaurants, and other businesses in the area surrounding the park, relative to baseline conditions. The incremental impact of each alternative depends in large part on the way that affected individuals and firms responded to the ban on PWC use in CALO. To the extent that local businesses that relied on PWC users prior to the ban were able to provide substitute products and services, they may have been able to reduce the negative impacts on their profits. In addition, although it is expected that PWC users would decrease their overall visitation to the park because of the ban, they will not necessarily stop visiting the area altogether, especially if PWC use is not their primary activity. It is also possible that visitation to CALO by non-PWC users has increased under the ban if the absence of PWC users makes park visitation more enjoyable for this group of people, although NPS is unable to quantify this impact because of a lack of data. The more that producers and consumers were able to make adjustments to mitigate the negative impacts of the ban, and the more that non-PWC users

increase their visitation under the ban, the smaller the incremental positive impacts of reinstating PWC use in CALO.[1]

Economic impact analyses tend to overstate the impacts associated with rules such as the management alternatives for PWC use in CALO because they do not account for behavioral changes that may mitigate impacts. However, these analyses are still very important to policy makers because they provide an estimate of the impact on the local area most directly affected by the regulation. In addition to the total impacts associated with a regulatory action, the distribution of those impacts is important. Because benefit-cost and economic impact analyses have different emphases and different final results, but both provide useful information for measuring the impact of different PWC management alternatives, both types of analyses are presented in this report.

The majority of the economic impacts are expected to be concentrated in Carteret County. Projected impacts on economic activity are compared to the size of the local economy to put the impacts in perspective.

3.1 SCENARIOS EXAMINED IN THIS REPORT

NPS estimates that 3,185 visitors used PWC during 2000, accounting for less than one percent of annual visitation.

As described in Section 2.2, PWC users accounted for a small fraction of total visitation to CALO prior to the ban in April 2002. NPS estimates that 3,185 visitors used PWC during 2000, accounting for only about 0.71 percent of annual visitation. Baseline visitation (i.e., with PWC banned from CALO) was projected through 2015 using the average annual visitation over 5 years, 2000 to 2004, as a starting point. Baseline visitation for non-PWC users was then assumed to increase at a rate equal to the 1992–2002 annual population growth rates in the seven-county region surrounding the park. The No-Action Alternative is assumed to be the same as baseline conditions, which maintains current conditions (PWC banned from CALO). Although there would be no PWC use in CALO in 2006–2015 under baseline conditions, it was assumed that 50 percent of the former PWC

[1]A decrease in expenditures for substitute activities in the CALO region relative to baseline conditions in response to allowing PWC use to resume would partially offset any positive regional impacts associated with Alternatives A and B. There may also be reallocation of revenue among businesses.

users would continue to visit the CALO region to enjoy other recreational activities.

PWC users are expected to change their visitation to CALO in response to changes in management of PWC use in the park. To estimate the magnitude of the resulting economic impacts, NPS constructed scenarios for the regulatory alternatives based on the available information. Under Alternative A, it is expected that visitation would be higher than under the baseline, continuing at projected values based on visitation in years prior to a ban on PWC use. For Alternative B, it is expected that PWC users will increase their visitation to the park relative to baseline conditions, but that visitation would not return to the levels that would have prevailed in the absence of the ban because of the geographic restrictions of this alternative. Under the No-Action Alternative, it is expected that visitation will not change relative to baseline projections because PWC management would not change relative to current conditions.

It is assumed that people who continue to visit the CALO area will have the same spending patterns as baseline conditions, except that some of them will resume renting or purchasing PWC under Alternatives A and B. It is possible that former PWC users have continued to visit the park to engage in other summer recreational activities and have increased expenditures on those activities, but because there is no information on the amount these users might have spent, this potential spending increase is not included in the analysis. In addition, as mentioned above, non-PWC users may have increased their visitation in response to the ban on PWC. To the extent that visitation by non-PWC users has increased following the ban on PWC use, the number of non-PWC users visiting this area may decrease relative to baseline because potential increases in noise and pollution resulting from changes in PWC management in CALO could decrease their enjoyment of the area.[1] However, neither the potential increase in non-PWC visitation under baseline conditions nor the potential decrease in non-PWC visitation were included in the analysis because of uncertainties in quantifying changes in visitation for this group of people and the associated changes in expenditure.

[1]This could result from an increase in the number of visitor-days for current non-PWC users and/or visitation by people who did not previously travel to the park.

NPS interviewed the sales and rental shops identified in the area to gain additional insight into the potential impacts on those businesses. The PWC dealerships contacted believed that restrictions on PWC use in CALO have caused a reduction in sales. Prior to the ban, CALO was an attractive destination for PWC use on the North Carolina coast. The rental shop contacted believed that the implementation of Alternative A or B might result in an increase in its PWC rentals. The predicted impacts for local businesses are discussed in Section 5.

Based on information collected from local businesses and CALO park staff, scenarios were developed for each of the proposed regulatory alternatives. The three primary scenarios that were analyzed for CALO are summarized in Table 3-1. For Alternatives A and B, NPS assumed that PWC use would be increasing at a 3 percent annual rate without the ban based on population and PWC/boat registration trends in North Carolina (NPS, 2004b). For visitors who do not currently use PWC, visitation to the park was assumed to be increasing at an annual rate equal to the average annual population growth rate over the last decade for counties surrounding the park. That growth rate was 0.58 percent, which is only half of the national growth rate of 1.16 percent over that time period (BEA, 2004). For baseline conditions, it was assumed that only 50 percent of the visitors no longer using PWC in CALO as a result of the ban would continue to visit the local area for alternative recreation purposes because of the lack of alternative PWC recreation areas close to CALO.

It was assumed that PWC visitation would increase to 100 percent of pre-ban levels under Alternative A and to 90 percent of pre-ban levels under Alternative B, and remain unchanged under the No-Action Alternative.

It was assumed that PWC visitation would return to 100 percent of pre-ban levels under Alternative A, to 90 percent of pre-ban levels under Alternatives B, and remain unchanged under the No-Action Alternative. PWC sales are assumed to increase to 100 percent of pre-ban levels under Alternative A, 90 percent of pre-ban levels under Alternative B, and to remain unchanged under the No-Action Alternative at 70 percent of pre-ban levels.

The scenarios outlined in Table 3-1 are used in Section 3.2 to provide estimates of potential economic impacts resulting from reinstating PWC use in CALO. The fewer former PWC users who would have continued to visit CALO to engage in alternative activities under the ban, the larger the overall impact of reinstating PWC use, other things being equal. Thus, the overall economic

impact of this regulation depends on the willingness of former PWC

Table 3-1. Assumptions Used in Analyzing Economic Impacts of CALO Regulatory Alternatives for PWC Use

	Alternative A	**Alternative B**	**No-Action Alternative**
Annual percentage change in the number of visitors using PWC in CALO that would have occurred in the absence of a ban[a]	3.00%	3.00%	NA
Baseline annual percentage change in non-PWC user visitation to CALO[b]	0.58%	0.58%	0.58%
Percentage of visitors who used PWC in CALO prior to the ban who are expected to continue visiting the park for other activities[c]	50%	50%	50%
Percentage of visitors using PWC in CALO prior to the ban who will resume PWC use in CALO as a result of reinstatement[c]	100%	90%	NA
Percentage of visitors renting PWC for use in CALO prior to the ban who will resume renting PWC for use in CALO as a result of reinstatement[c]	100%	90%	NA
Percentage of visitors purchasing PWC in the CALO region prior to the ban who will continue to purchase PWC in the CALO region[c]	100%	90%	70%[d]

[a]National Park Service (NPS). 2004b. *PWC and Boat Use Numbers and Trends.* Unpublished.

[b]U.S. Bureau of Economic Analysis (BEA). 2004. U.S. Department of Commerce, Regional Accounts Data. "Bearfacts." <http://www.bea.gov/bea/regional/bearfacts/>. As obtained August 2004.

[c]NPS estimates.

[d]This is the percentage of people who are expected to continue purchasing PWC at shops in the CALO region for use in other areas.

users who are prevented by the ban from using PWC in the park to continue visiting CALO to engage in alternative recreational activities.

3.2 ECONOMIC IMPACT OF PWC REGULATIONS ON LOCAL ECONOMIES

Generally, reinstating the use of PWC in CALO is expected to increase economic activity slightly in the areas surrounding the park.

The proposed regulations may affect the local economy in several ways, including changes in park visitation, sales and profits of local businesses, local employment, and local and state sales and income tax revenue. Generally, reinstating the use of PWC in CALO is expected to increase economic activity slightly in the areas surrounding the park. The following sections describe the estimated economic impacts on the region where the majority of the effects from increased visitation to CALO will be felt. All results tables in this section show the incremental impacts relative to the baseline projections.

3.2.1 Effect of Management Alternatives on CALO Visitation

All results tables in this section show the incremental impacts relative to the baseline projections.

Alternatives A and B are expected to lead to an increase in the number of visitor-days spent in CALO compared with the projected baseline, as shown in Table 3-2. This anticipated increase in the number of visitor-days is primarily due to the expectation that the majority of people who visited to use their PWC prior to the ban will return to the park if PWC use is reinstated. The actual increase in park visitation depends on several factors. Some people who previously used PWC in CALO may choose to continue visiting the park to enjoy alternative summer activities available within CALO, such as swimming, hiking, boating, and fishing. As mentioned earlier, visitation by non-PWC users may have increased in response to the PWC ban. Thus, if PWC are reinstated, visitation by non-PWC users is likely to decline to levels that would have occurred in the absence of the PWC ban because reinstating PWC may create a less enjoyable outdoor experience for some members of this group. This decrease in visitation would partially offset the increase in PWC users. However, neither the potential increase in visitation by non-PWC users in response to the PWC ban nor the expected decrease in visitation by non-PWC users if PWC are reinstated are quantified in this analysis because the extent to which non-PWC users would change their visitation is unknown.

3.2.2 Impact of Management Alternatives on Local Business Output

As a result of the incremental increase in visitation to the CALO area expected under Alternatives A and B, there will be a corresponding increase in the value of local business output. The primary sectors affected by increases in summer visitation are the tourism sectors, including PWC sales shops, hotels, restaurants, and retailers. As discussed in Appendix A, although the direct impact of an increase in visitor spending is primarily felt in these sectors, many additional sectors of the economy will be affected to some extent through secondary impacts. NPS focuses on the impacts estimated for reinstating visitation in the first year after implementation of the new regulation concerning PWC use. Impacts in subsequent years will be similar although they are expected to become larger over time as a result of the projected increase in incremental visitation after the

Table 3-2. Incremental CALO Visitation under Regulation Relative to Baseline Conditions[a]

	Alternative A			Alternative B		
Year	PWC Users[b]	Non-PWC Users[c]	Total Visitation	PWC Users[b]	Non-PWC Users[c]	Total Visitation
2006	4,586	–2,293	2,293	4,128	–2,293	1,835
2007	4,724	–2,293	2,431	4,251	–2,293	1,958
2008	4,866	–2,293	2,572	4,379	–2,293	2,086
2009	5,012	–2,293	2,718	4,510	–2,293	2,217
2010	5,162	–2,293	2,869	4,646	–2,293	2,353
2011	5,317	–2,293	3,024	4,785	–2,293	2,492
2012	5,476	–2,293	3,183	4,929	–2,293	2,635
2013	5,641	–2,293	3,347	5,076	–2,293	2,783
2014	5,810	–2,293	3,517	5,229	–2,293	2,936
2015	5,984	–2,293	3,691	5,386	–2,293	3,093

[a]NPS generated these estimates using the assumptions in Table 3-1.

[b]This column includes those visitors who use PWC in the park prior to implementation of the ban on PWC use in CALO and who would resume PWC use in the park if it were authorized under Alternative A or B. It includes both former PWC users who were assumed to visit the park for other activities during the ban (who are recategorized from non-PWC users to PWC users in this table) and former PWC users who were assumed to stop visiting the park if they are unable to use their PWC (their return to visiting the park leads to a net increase in visitation relative to baseline for Alternatives A and B).

[c]These are the former PWC users who were assumed to continue to visit the park to engage in alternative activities under baseline conditions. If PWC use is authorized, these visitors are expected to resume using PWC in the park and are counted as PWC users rather than non-PWC users in the table.

No data are available concerning the increase in the number of PWC rented, sold, and serviced annually that would result from reinstatement in CALO. Thus, NPS used information from local businesses on their pre-ban revenues and the projected increases in PWC sales, rentals, and storage to project the total increase in revenue for these categories.

first year (see Table 3-2). The impact in all years is expected to be very small relative to the size of the local economy.

To estimate spending impacts, it is necessary to obtain spending information for use with this study's estimates on changes in visitation. No data are available concerning the reduction in the number of PWC rented, sold, serviced, and stored annually that would result from changes in PWC regulations in CALO. Thus, NPS used information from local businesses on their baseline revenues and the projected increase in PWC sales, rentals, and storage shown in Table 3-1 to project the total increases in revenue for these categories.

For categories of tourism spending other than direct spending on PWC, spending profiles were used in conjunction with estimated changes in visitation to determine the total change in park-related expenditures. The Money Generation Model-Version 2 (MGM2), which is often used by NPS to estimate local economic impacts associated

with national park visitation, provides generic spending profiles for national parks (MGM2, 2002).[1]

NPS does not have data concerning the nature of visits taken in the park: for example, whether they are day trips, or overnight. However, in a 1993 visitor use study conducted in the park approximately 30 percent of visitors were assumed to be local due to their reported zip code (Texas A&M, 1995). Absent other information, NPS assumes 30 percent of visitors are local day users and 40 percent are non-local visitors staying in motels outside the park. The remaining 30 percent of visitors were assumed to be split evenly between non-local day users, backcountry campers, and people visiting friends and relatives. Absent any data to estimate the relative size of these users groups, NPS made these assumptions based on professional judgment. Table 3-3 provides spending per party estimates used by MGM2 for these visitor-type groups. Only spending categories with positive average expenditures reported for these groups of

[1]See Appendix B and the MGM2 website <http://www.msu.edu/user/stynes/npsmgm/> for more information about economic impact analysis using input-output [I-O] models.

visitors are included in the table. For this analysis, the medium[1] estimate was used for all of the spending categories analyzed. Because there is no spending category included that represents boat rentals, purchases, service, or storage, it was assumed that the spending estimates from MGM2 are in addition to the directly PWC-related expenditures described above.

To estimate the direct impact on CALO business revenues, NPS calculated the increase in the number of parties visiting CALO using data on party sizes and projected changes in visitation from Section 2.[2] NPS then multiplied the increase in the number of parties visiting the CALO region by their estimated spending in each category for scenarios developed under each alternative. These scenarios are described in detail in Section 3.1. The increase in the

Table 3-3. Spending Profiles for Visitors to National Parks (2001$)[a]

	Spending per Party		
	Low	**Medium**	**High**
Local Day User			
Restaurants and bars	$8.64	$12.35	$16.05
Groceries/take-out	$4.33	$6.19	$8.04
Gas and oil	$3.37	$4.82	$6.27
Other vehicle expenses	$0.36	$0.52	$0.67
Admissions and fees	$2.94	$4.21	$5.47
Clothing	$0.69	$0.98	$1.28
Sporting goods	$0.70	$1.00	$1.29
Souvenirs and other expenses	$4.68	$6.68	$8.69
Total	$25.72	$36.74	$47.76
Non-local Day User			
Restaurants and bars	$11.52	$16.46	$21.40
Groceries/take-out	$4.33	$6.19	$8.04
Gas and oil	$6.75	$9.64	$12.53
Other vehicle expenses	$0.54	$0.78	$1.01
Local transportation	$0.18	$0.26	$0.33

[1]MGM2 provides low, medium, and high expenditure estimates for each spending category.

[2]Although the average party sizes of PWC users and non-PWC users in CALO may differ from the default party sizes assumed by MGM2, the number chosen for group size does not affect results as long as spending per person is proportional. Increasing the group size in the model would have no effect on impact calculations as long as the number of groups decreased and spending per group increased proportionately.

Admissions and fees	$5.15	$7.36	$9.57
Clothing	$1.38	$1.96	$2.55
Sporting goods	$0.70	$1.00	$1.29
Souvenirs and other expenses	$6.48	$9.26	12.03
Total	$37.03	$52.90	$68.77
Backcountry Campers			
Motel, hotel, cabin, or B&B	$3.40	$4.86	$6.32
Camping fees	$1.51	$2.16	$2.81
Restaurants and bars	$4.37	$6.25	$8.12
Groceries/take-out	$3.14	$4.48	$5.83
Gas and oil	$4.73	$6.76	$8.78
Other vehicle expenses	$0.33	$0.47	$0.61
Admissions and fees	$2.48	$3.54	$4.60
Clothing	$0.65	$0.92	$1.20
Sporting goods	$1.73	$2.47	$3.21
Souvenirs and other expenses	$4.58	$6.54	$8.50
Total	$26.91	$38.45	$49.98

(continued)

Table 3-3. Spending Profiles for Visitors to National Parks (2001$)[a] (continued)

	Spending per Party		
	Low	**Medium**	**High**
Motel Outside the Park			
Motel, hotel, cabin, or B&B	$56.33	$80.47	$104.61
Restaurants and bars	$27.37	$39.10	$50.83
Groceries/take-out	$7.22	$10.31	$13.40
Gas and oil	$6.07	$8.68	$11.28
Other vehicle expenses	$1.09	$1.55	$2.02
Local transportation	$0.36	$0.51	$0.67
Admissions and fees	$8.83	$12.62	$16.41
Clothing	$4.13	$5.89	$7.66
Sporting goods	$0.70	$1.00	$1.29
Souvenirs and other expenses	$8.64	$12.34	$16.04
Total	$122.70	$175.28	$227.86
Visiting Friends and Relatives			
Restaurants and bars	$8.64	$12.35	$16.05
Groceries/take-out	$8.66	$12.37	$16.08
Gas and oil	$6.07	$8.68	$11.28
Other vehicle expenses	$0.54	$0.78	$1.01
Local transportation	$0.18	$0.26	$0.33
Admissions and fees	$3.68	$5.26	$6.84
Clothing	$2.06	$2.95	$3.83
Sporting goods	$1.39	$1.99	$2.59
Souvenirs and other expenses	$7.92	$11.31	$14.71
Total	$39.16	$55.94	$72.72

[a]These values are based on the average expenditures per party for visitors to national parks based on an unweighted average of survey values for Everglades National Park, Great Smoky Mountain National Park, Mammoth Cave National Park, Death Valley National Park, Glacier National Park, and Big South Fork National Recreation Area. However, the number of people per party assumed by MGM2 may differ between visitor segments.

Source: Money Generation Model—Version 2 (MGM2). 2002. <http://www.msu.edu/user/stynes/npsmgm/>. As obtained July 2002.

number of PWC users to the area will directly increase the revenues of the PWC rental, sales, and service shops as well as the revenues of restaurants and other stores patronized by PWC users.

Table 3-4 provides estimates for each alternative of the direct changes in revenues caused by a change in visitation based on the generic spending profiles for national parks and the

information provided by local businesses. It was assumed that revenue would

Table 3-4. First Year Direct Impact of PWC Regulations on Business Revenues in CALO Region Relative to Baseline (2005$)[a,b]

	Alternative A	Alternative B
PWC Rentals	$11,780	$10,600
PWC Sales/Service	$910,040	$606,690
Motel, Hotel, Cabin, or B&B	$14,070	$11,250
Camping Fees	$270	$220
Restaurants and Bars	$13,380	$10,700
Groceries/Take-Out	$5,460	$4,370
Gas and Oil	$5,200	$4,160
Other Vehicle Expenses	$600	$480
Local Transportation	$130	$100
Admissions and Fees	$4,850	$3,880
Clothing	$1,760	$1,410
Sporting Goods	$980	$790
Souvenirs and Other Retail	$6,460	$5,170
Total	$974,980	$659,820

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]NPS generated these estimates using the MGM2 model (MGM2, 2002). Model results were inflated to 2005$ using the consumer price index (BLS, 2005).

be unchanged relative to baseline under the No-Action Alternative. For Alternative A, NPS estimated PWC sales and service revenue to increase by $974,980 relative to the baseline estimate, while PWC rental revenue is estimated to increase by $11,780 relative to the baseline estimate. Under Alternative B, NPS estimated that PWC sales and service revenue and PWC rental revenue would increase by $606,690 and $10,600, respectively, relative to the baseline.[1]

For the other spending categories (those that are included in MGM2), the total change in expenditures was calculated by multiplying the change in number of parties of each type (i.e., local

[1]Estimated impacts on PWC rentals, sales, and service are informed by interview data collected from local firms. See Section 5 for additional information.

day users and non-local day users) by the average expenditure per party for that type of visitor for each expenditure category.

As shown in Table 3-4, the largest direct impact is on establishments offering PWC sales/services, accounting for over 90 percent of the estimated revenue increases resulting from allowing PWC to return to CALO. The increase in PWC sales and service revenue is followed by motel, hotel, cabin, or Bed & Breakfast (B&B); restaurants and bars; PWC rentals; souvenirs and other retail; groceries/take-out; gas and oil; admissions and fees; clothing; sporting goods; other vehicle expenses; camping fees; and local transportation.

Note that the estimated increases in revenue in Table 3-4 overstate the true direct gains to the region because part of the sales value in the groceries/take-out, gas and oil, clothing, sporting goods, and souvenirs/retail categories goes to individuals and firms outside of the region and thus cannot be considered a gain to the CALO region. Using these changes in revenues as inputs into MGM2, NPS estimated the total regional impacts on output. As discussed in Appendix A, only the gain of the retail markup in the retail sector can be included as an increase in regional output for the local area. This explains why the direct effect on the region estimated by MGM2 (reported in Table 3-5) is smaller than the change in revenues provided as input.

Table 3-5. First Year Total Impacts on Value of Output for CALO Region (2005$)[a,b]

	Alternative A	Alternative B
Direct Effect	$434,330	$298,060
Total Impact	$604,910	$415,550

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]NPS generated these estimates using the MGM2 model (MGM2, 2002). Model results were inflated to 2005$ using the consumer price index (BLS, 2005).

In addition to the direct effect of the regulation on the regional economy, the indirect and induced effects (ripple effects on input suppliers and from changes in household income, respectively) are estimated (see Appendix A). The multipliers used for this analysis are those provided in MGM2 for a typical small metropolitan area. Table 3-5 also summarizes the total impacts on the value of output for businesses in the CALO region. In this case, the multiplier effects are moderate. The total impact is

The impacts of PWC regulation in CALO on regional output are estimated to be negligible (about 0.04 percent of local personal income) even under the alternative with the most positive impact (Alternative A).

about 40 percent larger than the direct effect. The total impact estimated for Alternatives A

and B varies from $604,910 to $415,550 and depends on how many people resume visiting the park as a result of reinstating PWC use.

No incremental impacts are anticipated for the No-Action Alternative since it maintains baseline conditions. The level of personal income in Carteret County was about $1.67 billion in 2002 (BEA, 2004), or $1.80 billion when converted to 2005 dollars. Thus, the impacts of PWC regulation in CALO on regional output are estimated to be negligible (approximately 0.04 percent of local personal income) even under the alternative with the most positive impact (Alternative A).

3.2.3 Change in Value Added

Another measure of the impact on the local economy is the change in value added as a result of the regulation. Value added is the amount of dollar value contributed to a product at each stage of its production. It is calculated at each stage by subtracting the costs of intermediate goods from the value of the final good to avoid double-counting the value of intermediate goods. It will be a smaller value than output because it excludes the value of intermediate goods, whereas output measures do not exclude all intermediate goods. The output measure only excludes the cost of goods produced in other regions resold by wholesalers or retailers. To calculate these values for CALO, the MGM2 data for value added as a share of total output in each sector were applied to the estimated changes in local output presented in Table 3-5 to get the direct effect on value added by sector. The MGM2 multiplier for value added in each sector was then applied to estimate the total impact. Table 3-6 provides the total change in value added for the local region as a result of the proposed regulations.

Table 3-6. First Year Total Impacts on Value Added for CALO Region (2005$)[a,b]

	Alternative A	Alternative B
Direct Effect	$215,290	$147,740
Total Impact	$428,580	$293,000

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]NPS generated these estimates using the MGM2 model (MGM2, 2002). Model results were inflated to 2005$ using the consumer price index (BLS, 2005).

3.2.4 Effect on Personal Income

Personal income is a portion of value added in which policy makers are commonly interested. It comprises employee compensation and proprietor income. Table 3-7 shows how labor income in the CALO region changes as a result of the alternatives reinstating PWC use. This value is smaller than value added because it includes only a subset of the components of value added, but it is often useful to break value added down in this way to estimate the effect on regional personal income. Similar to value added, the direct effect of this component is calculated using the MGM2 data for personal income as a share of output in each sector. The total effect is then calculated by multiplying the direct effect by the personal income multiplier included in MGM2 for each sector.

Table 3-7. First Year Total Impacts on Personal Income for CALO Region (2005$)[a,b]

	Alternative A	Alternative B
Direct Effect	$141,670	$97,220
Total Impact	$267,400	$183,240

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]NPS generated these estimates using the MGM2 model (MGM2, 2002). Model results were inflated to 2005$ using the consumer price index (BLS, 2005).

3.2.5 Change in Employment

Another effect of the proposed regulations is to increase employment in the sectors affected by the rules. These changes are calculated by MGM2 based on ratios of sales to employment for the affected industries in the CALO area. As a result of the increase in sales anticipated under this regulation, companies will need additional employees. The estimated increase in employment ranges from 8.3 to 14.8 employees for Alternatives A and B. No changes in employment are expected for the No-Action Alternative since it maintains baseline conditions. These values are calculated based on MGM2 data on the number of employees per million dollars of output in each industry. Estimated changes

in the number of employees are therefore equal to the change in output times the number of employees required per unit of output. Table 3-8 summarizes the results of the employment analysis.

Table 3-8. First Year Total Change in Employment for CALO Region (number of jobs)[a]

	Alternative A	Alternative B
Direct Effect	12.1	8.3
Total Impact	14.8	10.1

[a]NPS generated these estimates using the MGM2 model (MGM2, 2002).

3.2.6 Change in Tax Revenue

In addition to impacts on the local businesses operating near CALO, there is also an impact on the state and local governments. The state income tax rate for North Carolina ranges from 6.0 to 8.25 percent. For this analysis, the midpoint of the tax rate (7.125 percent) was used. There is no local income tax in Carteret County. North Carolina's sales tax rate is 4.5 percent. Carteret County charges 2.5 percent sales tax in addition to the state sales tax. State income taxes from Carteret County are estimated to increase by between $6,930 and $10,090 for Alternatives A and B, as presented in Table 3-9, based on estimated changes in business revenue. State sales tax receipts are predicted to increase by $29,690 to $43,870. Local sales taxes are estimated to increase by $16,500 to $24,370, depending on the regulatory alternative. No changes in sales or income taxes are expected under the No-Action Alternative since it maintains baseline conditions.

Table 3-9. First Year Change in State and Local Sales Tax Revenue[a,b]

	Alternative A	Alternative B
State		
Income tax	$10,090	$6,930
Sales tax	$43,870	$29,690
Local		
Income tax	$0	$0
Sales tax	$24,370	$16,500

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]NPS generated these estimates using the MGM2 model (MGM2, 2002). Model results were inflated to 2005$ using the consumer price index (BLS, 2005).

3.2.7 Summary

Several different measures of the economic impacts resulting from reinstating PWC use in CALO are presented in this section. Each measure provides slightly different information about the expected economic effects on the region. Income and value added are generally considered the best measures of economic impacts because sales and job estimates can be misleading. Sales or output measures include spending on inputs purchased outside the region, and job estimates are distorted by part-time and seasonal positions because the data available are on jobs, not on full-time equivalents.

NPS estimates that the total impact on regional output is $604,910 for Alternative A and $415,550 for Alternative B. No impacts are expected under the No-Action Alternative since it maintains baseline conditions. These gains are very small compared to the size of the regional economy, even under Alternative A, the alternative with the largest impacts.

In addition, the wage rates across different jobs vary widely across industries (Stynes, 2000). Income and value added measures both avoid these difficulties and concentrate on changes that affect only the CALO region.

In the analysis presented here, NPS estimates that the total impact on regional output of the proposed alternatives for regulating PWC use in CALO is $604,910 for Alternative A and $415,550 for Alternative B in the first year after implementation (see Table 3-5). No impacts are expected under the No-Action Alternative since it maintains baseline conditions. These gains are quite small compared to the size of the regional economy, even under Alternative A (the alternative with the largest impacts). In 2002, average total personal income in the counties surrounding CALO was approximately $1.80 billion in 2005 dollars (BEA, 2004; BLS, 2005). Thus, even if all revenues related to PWC use in CALO were to return to the regional economy, the impact would be very small (regional output would increase by approximately 0.04 percent of personal income), although some businesses and communities in the county that rely heavily on PWC users may experience localized impacts.

3.2.8 Uncertainty

A number of factors will affect the regional economic impacts associated with the proposed alternatives. The 1996 EPA Marine Engine Rule, enacted by EPA in 1996, may have an impact on PWC use nationally and in CALO. As described in Section 2.2.4, this rule requires PWC (and other spark-ignition marine engine) manufacturers to phase in emissions reductions of 75 percent

between the 1998 and 2006 model years (*Federal Register*, 1996). These emissions reductions are expected to increase the cost of producing PWC over time. The corresponding increase in market price of PWC may lead to a reduction in sales that would reduce PWC ownership and use relative to the projected levels. This would tend to reduce the incremental costs and benefits attributable to NPS regulations in future years. However, production cost increases due to these regulations are probably captured in the current baseline to some degree because the rule has already required some reduction in emissions.

NPS identified the following additional uncertainties:

Although NPS has provided its best estimate of the regional economic impacts associated with the proposed alternatives, numerous sources of uncertainty may influence the results.

- The projections of baseline PWC use through 2015 in the absence of a ban were based on ranger counts of PWC in select days in 2000 and the population and PWC/boat registration trends in North Carolina. To the extent that PWC users accounted for an unusually small or large proportion of total visitation in 2000, baseline visitation by PWC users may be understated or overstated. In addition, the trends in North Caroline PWC/boat registration may not constitute a good proxy for the future annual change in visitation to CALO by PWC users in the absence of a ban. It may understate or overstate the actual change in CALO PWC use that would occur in future years under pre-ban conditions. The uncertainties associated with this estimate are discussed in further detail in Section 2.2.
- The proportion of PWC users who would have continued to visit the park under the ban on PWC use is unknown. As a result, the incremental increase in visitation resulting from reinstating PWC use may be higher or lower than calculated in this analysis.
- Non-PWC users may have increased visitation following the ban. To the extent that they would reduce their visitation relative to the baseline if PWC use were reinstated, the positive impacts to local businesses of reinstating PWC use would be partially offset. Because insufficient information regarding this effect was available, this potential impact was not quantified in the analysis, which will tend to overstate the regional impacts.
- Generic spending patterns and multipliers from MGM2 were used to represent economic activity in the CALO area. To the extent that spending patterns of PWC users in CALO differ from the generic spending of local and non-local day users and/or the generic multipliers for a national park in a small metropolitan area differ from the multipliers for the CALO region, the impacts may be understated or overstated.

In addition, the general uncertainties and caveats are associated with the use of Input-Output (I-O) models. These factors are described in further detail in Appendix A.

4 Benefit-Cost Analysis of the Alternative Regulations

The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case the regulation of PWC use in national parks. The impacts of this action, both the benefits and costs, will ultimately be experienced as changes in well-being for households/individuals.

The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case the management of PWC use in national parks. It examines whether the reallocation of society's resources resulting from the action promotes efficiency. That is, it assesses whether the action results in benefits (gains in social welfare) greater than the associated costs to society (losses in social welfare).

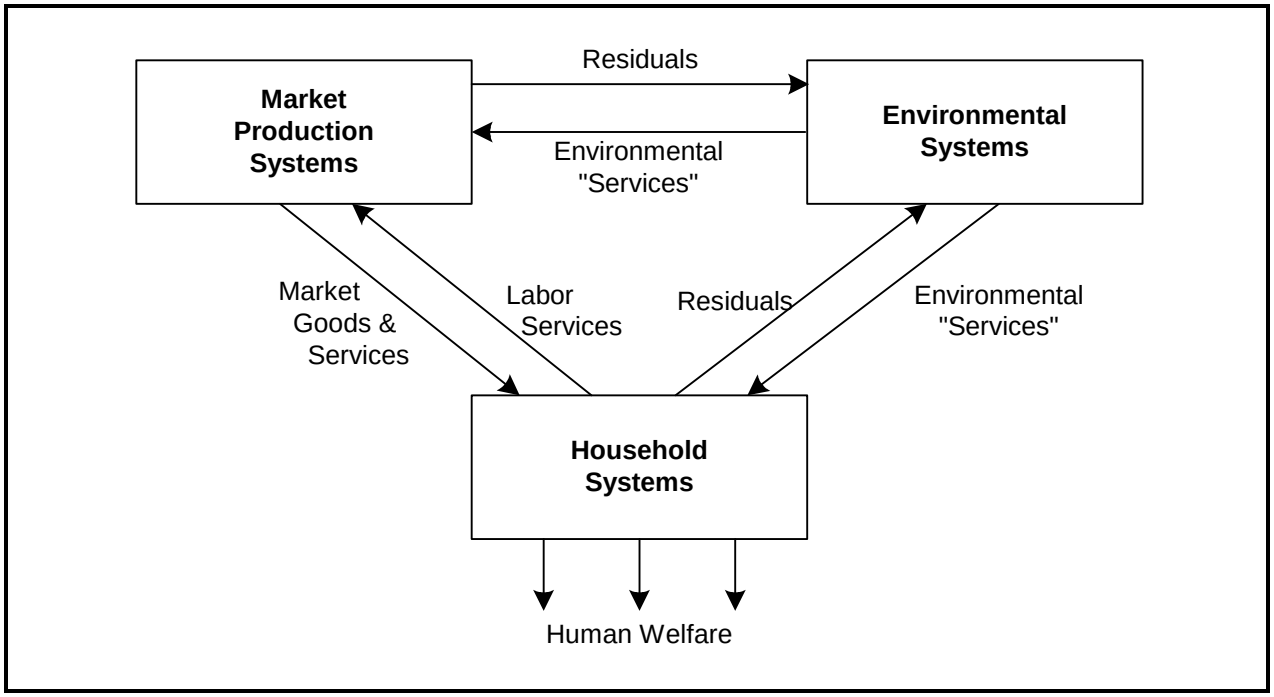
Section 4.1 provides a general outline of the approach to benefit-cost analysis and the possible benefits and costs of PWC regulations in national parks. Section 4.2 presents the analysis for CALO specifically.

4.1 CONCEPTUAL BASIS FOR BENEFIT-COST ANALYSIS OF PWC RESTRICTIONS IN NATIONAL PARKS

According to the conceptual underpinnings of benefit-cost analysis, all social welfare impacts ultimately accrue to individuals.[1] This is represented in Figure 4-1, which depicts flows of goods, services, and residuals among three major systems: market production, household, and the environment. Because these systems are closely

[1] In practice, analysts often look at welfare impacts for groups of individuals, such as PWC users versus non-PWC users.

Figure 4-1. Interrelationship Among Market, Environmental, and Household Systems and Social Welfare



interconnected, actions taken to reduce releases of harmful residuals (e.g., chemicals or noise pollution) to the environment will potentially reverberate throughout all of these systems.

Nevertheless, the impacts of these actions, both the benefits and costs, will ultimately be experienced as changes in well-being for households/individuals. As a result, identifying and measuring benefits and costs must focus on these changes in well-being.

The conceptual framework depicted in Figure 4-1 therefore provides a basis for assessing the benefits and costs of PWC regulations in national parks. In these cases, the most direct impact will be on households that use PWC, whose recreational opportunities will be affected by the regulations. This will result in direct changes in welfare for these households. In addition, the resulting changes in the behavior of these households are likely to affect environmental systems and market systems. Effects on these systems will indirectly affect the welfare of other households. For example, the park environment will be improved or degraded, and this change will affect the “services” (primarily recreation-related) that the park provides to other households and

individuals in society. Businesses that cater to non-PWC visitors may also be affected if the number of people visiting the park changes. On the other hand, the resulting changes in the market demand for PWC-related goods and services will have impacts for those who own or work for establishments supplying these services.

These types of direct and indirect impacts are identified and evaluated as part of this benefit-cost analysis. Specifically, in Section 4.2 NPS estimates the incremental benefits and costs relative to the baseline.

In certain instances, welfare changes are directly the result of monetary gains or losses and can therefore be thought of as being equivalent to these gains or losses. In other instances, welfare changes are not directly associated with pecuniary gains or losses.

Estimating the value of benefits and costs also requires methods for expressing welfare changes in monetary terms. In certain instances, welfare changes are directly the result of monetary gains or losses and can therefore be thought of as being equivalent to these gains or losses. For example, welfare gains or losses to PWC sales shops due to changes in demand for their services can be reasonably measured as their resulting net change in income. In other instances, welfare changes are not directly associated with pecuniary gains or losses. Such "non-market" changes might, for example, include the welfare gains or losses from improved or degraded recreational opportunities in a park. In these cases a surrogate measure of gains or losses must be used; willingness to pay (WTP) is such a surrogate. Economists and other practitioners of benefit-cost analysis generally accept WTP as the conceptually correct measure for valuing changes in individuals' welfare. WTP represents the maximum amount of money that an individual would be willing to forgo to acquire a specified change. As such, it is the monetary equivalent of the welfare gain from the change.

Using this conceptual framework for identifying, measuring, and valuing changes in societal welfare, the remainder of this section and Appendix B provide a more detailed discussion of

- the types of benefits and costs associated with PWC restrictions in national parks and
- the approaches used in measuring these benefits and costs.

4.1.1 Social Costs of PWC Use

Use of PWC in national parks may be associated with a number of negative impacts on environmental resources and ecosystems. The extent to which adverse impacts will be realized is a function of several factors, including the level of use, the technology of the machines being used, and the extent to which users remain in designated areas. One result of any negative impacts that occur is that they impose welfare losses on individuals who value the parks' environmental systems. The negative impacts of PWC use on other people are also referred to as negative externalities. If PWC do generate negative externalities without compensation, then this represents a market failure. The private cost of using a PWC (the cost to the individual PWC user) will be lower than the social cost of PWC use (where the social cost of PWC use includes both the cost to the PWC user plus the costs to others that result from the negative externalities associated with PWC use). Because PWC users do not have to pay the full social cost of using a PWC and instead only pay the lower, private cost, PWC use will be maintained at a higher level than socially optimal in the absence of regulation.

Because PWC users do not have to pay the full social cost of using a PWC and instead only pay the lower, private cost, PWC use will be maintained at a higher level than socially optimal in the absence of regulation.

The costs of allowing PWC in national parks can therefore be thought of and measured as the increase in these incremental losses to society. In addition, use of PWC can negatively affect society in ways that are not directly related to the environment; therefore, the incremental costs of PWC regulations must also include increases in these non-environmental losses.

Table 4-1 provides a broad classification of the types of environmental and non-environmental impacts associated with PWC use in national parks. In this section, this classification is used to more completely identify, categorize, and describe the full range of potential benefits associated with PWC restrictions in national parks in general. In Section 4.2.3, this framework is then used to specifically describe the costs that are expected to result from the management alternatives for CALO.

Environmental Costs of PWC Use

The use of PWC may have adverse impacts on air quality, natural resources (e.g., water quality, habitat), wildlife, and natural quiet.

Figure 4-2 depicts the various categories of potential adverse effects to the environment through which PWC use in national parks can impose welfare losses on society.

Table 4-1. Classification of Potential Negative Impacts from PWC Use in National Parks

Impact Categories	**Examples of Impacts**
Environmental Impacts	
Aesthetic	Noise, visibility, odor
Human health	Through impacts to air and water quality
Ecosystems	Loss of or damage to habitat and wildlife
Non-environmental Impacts	
Infrastructure	Costs of monitoring, maintenance, and law enforcement
Human safety	Accidents
Cultural, Historical, and Archeological	Physical damages

- Typical (two-stroke engines) PWC release substantial amounts of noise and pollutants into the environment. Noise from PWC impairs the natural soundscape for park visitors and has the potential to negatively affect wildlife in the park. Emissions from PWC can also negatively affect park ecosystems, human health, and visitor experiences. The three primary reasons for the potential impacts due to release of pollutants are as follows:
  - √ up to one-third of the fuel delivered to the engine is expelled without being burned,
  - √ lubricating oil is mixed with fuel and thus is expelled as part of the exhaust, and
  - √ the combustion process results in emissions of air and water pollutants.

Pollutants are directly released to air and water, causing contamination of air and water resources.

As shown in Figure 4-2, all of these impacts can, directly or indirectly, lead to losses in human welfare. Therefore, from a benefit-cost perspective, those who ultimately lose from actions to allow PWC will be individuals who value the quality of the park environment. Many of those that experience losses will be park visitors whose recreational experiences are disturbed. As a point of reference, Table 4-2 reports average consumer surplus values that have been estimated for common non-PWC related summer

recreation activities from a study by Rosenberger and Loomis (2000). These are the types of recreation values that may be diminished by the presence of PWC.

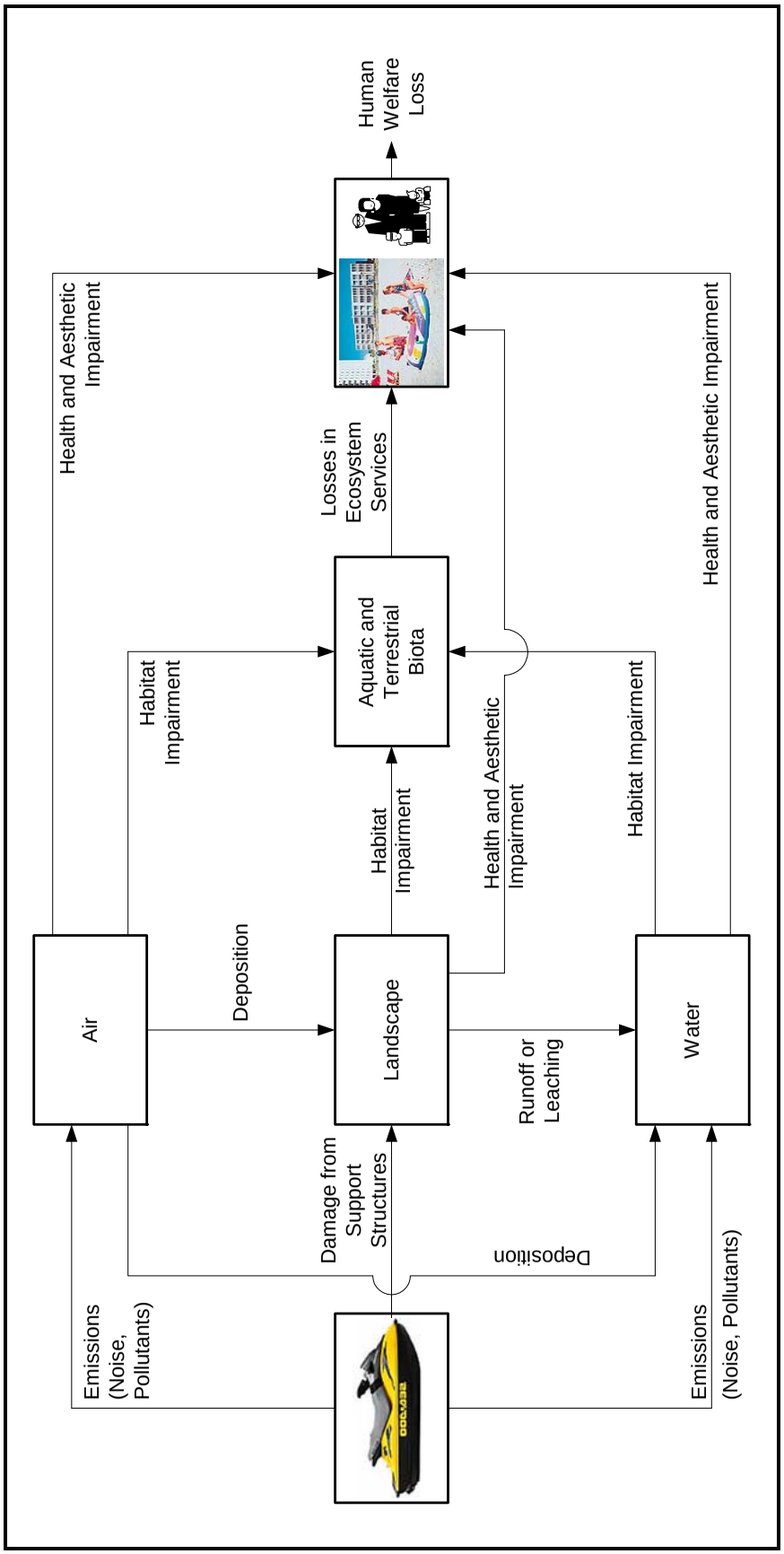


Figure 4-2. Routes of Environmental Damages and Human Welfare Losses from PWC Use in National Parks

Table 4-2. Summary of Average Recreation Values (2005$ per Person per Day) for Selected Activities by Region[a,b]

Activity	Study Location					U.S. Average
	Northeast	Southeast	Mountain	Pacific	National[c]	
Picnicking	65.05 (1)	43.87 (1)	42.78 (7)	87.10 (2)	18.48 (1)	50.08 (12)
Swimming	43.82 (5)	NA	NA	17.61 (1)	24.35 (1)	37.30 (7)
Hiking/Backpacking	53.02 (2)	129.53 (2)	44.08 (3)	24.01 (6)	24.58 (1)	47.57 (14)
Fishing	37.26 (42)	32.68 (13)	50.05 (39)	43.72 (16)	43.89 (4)	42.25 (114)
Motor Boating	61.77 (2)	NA	81.00 (2)	17.82 (1)	45.59 (1)	58.16 (6)

NA = Not available.

[a]All amounts were inflated using the consumer price index available from the U.S. Bureau of Labor Statistics (BLS, 2005). Numbers in parentheses represent the number of observations (i.e., studies).

[b]These values were taken from multiple studies conducted between 1967 and 1998.

[c]Studies estimating nationwide values.

Source: Rosenberger, Randall, and John Loomis. 2000. "Using Meta-Analysis for Benefit Transfer: In-Sample Convergent Validity Tests of an Outdoor Recreation Database." *Water Resources Research* 36(4):1097-1107.

The value that people place on a particular recreational activity depends strongly on the availability of substitutes. In areas where numerous areas are available for recreational activities, the value of improving environmental conditions in one of those areas will tend to be smaller.

The value that people place on a particular recreational activity depends strongly on the availability of substitutes. In regions where there are numerous areas available for recreational activities, the value of changing environmental conditions in one of those areas will tend to be smaller. The reason is that there are already many other areas where people can engage in the same activity. Unless there are unique characteristics that people value in the area where conditions will be improved or degraded, there will probably be relatively small benefits or costs as a result of the environmental change. On the other hand, in regions with few substitutes for the local national park that would potentially experience environmental damage as a result of the regulations, the losses to park users may be much greater.

Even individuals who are not park visitors (i.e., nonusers) can benefit from the knowledge that park resources are being protected and preserved. In other words, they may hold positive or negative "nonuse values" (i.e., a positive WTP) for protecting or degrading the park environment. These nonuse values can stem from the desire to ensure others' enjoyment (both current and future generations) or from a sense that these resources have

some intrinsic value. Pearce and Moran [1994] review studies that have attempted to estimate nonuse values for the protection of unique species and ecosystems. The measurement of nonuse value remains controversial, and in this report NPS does not attempt to quantify the possible benefits or costs associated with nonuse values. Allowing PWC use in national parks can therefore result in losses to both users and nonusers in a number of ways by degrading the parks' ecological resources.

Appendix B provides a more detailed discussion of the non-environmental impacts, in particular, and how these restrictions can affect public safety in national parks and reduce the costs of operating and maintaining the infrastructure necessary to support and monitor PWC use.

4.1.2 Social Benefits of PWC Use

The primary benefits associated with allowing the use of PWC in national parks will accrue to

- PWC users, especially individuals who would otherwise not use PWC in the park as a direct result of the ban on PWC use, and
- providers of PWC-related services for park visitors.

Just as Section 4.1.1 described potential consumer surplus losses to other park visitors and the public associated with PWC use, the potential welfare gains to PWC users are measured in terms of consumer surplus. Regulations that restrict the use of PWC impose costs on PWC users. For instance, prohibiting PWC use in the park has resulted in a loss of the consumer surplus for former CALO PWC users. Reinstating PWC use in CALO under Alternative B, which imposes restrictions such as limiting PWC use to special use areas and only operating perpendicular to the shore at flat-wake speeds, would increase the consumer surplus of PWC users relative to baseline. A return to pre-ban PWC management practices under Alternative A, with no geographic restrictions, would increase the consumer surplus of PWC users more than under Alternative B.

As with other activities, the extent of the welfare loss to an individual rider depends crucially on the availability of substitute areas to use PWC and/or to engage in other recreational activities. All else equal, individuals who have fewer substitutes for PWC use (either other places to use PWC or other activities

they enjoy as much) enjoy greater consumer surplus from PWC use in a particular body of water and thus will experience a greater gain in welfare if that body of water is opened to PWC use.

After conducting an extensive review of the economics literature and consulting with the authors of existing studies, experts in recreation demand analysis at universities, and other experts, NPS was unable to locate a study that estimated the consumer surplus associated with a PWC trip. Table 4-2 presents the results of a review of the recreation literature conducted by Rosenberger and Loomis (2000). The review found an average value of $49.37 (1996 dollars) per person per day for riding in motor boats (with estimates ranging from $15 to over $65). The same study reports a value of $26.79 (1996 dollars) per person per day (with estimates ranging from $20 to over $30) for off-road driving. Bhat et al. (1998) report consumer surplus estimates ranging from $9.12 to $54.93 for motorboating and waterskiing in different regions of the country. These estimates, along with the estimates in Table 4-2, provide a range of values for activities similar to riding PWC and provide a bound on the consumer surplus for PWC users expected from the regulations. Note that measures of net consumer surplus to PWC riders that do not account for the additional costs imposed on society by the negative externalities associated with PWC use will overstate the true net social welfare associated with the activity.

After conducting an extensive review of the economics literature and consulting with the authors of existing studies, experts in recreation demand analysis at universities, and other experts, NPS was unable to locate a study that estimated the consumer surplus for a PWC trip.

Even PWC users who do not currently visit the park may have a positive value associated with maintaining access for PWC in parks that they could potentially decide to visit in the future. These users hold an option to visit the park in the future. Restrictions on PWC access to parks would reduce or eliminate the value of that option. Thus, PWC users who do not visit the park may still experience a gain in welfare if the park allows PWC use. However, due to a lack of information concerning the population of PWC users who may potentially choose to visit a given park in the future and the value that they place on that option, NPS does do not attempt to quantify the potential gains in option value.

An increase in PWC use at a particular park may also affect businesses that offer services to PWC users. These businesses are not directly affected by NPS regulations of PWC users (i.e.,

none of the regulations directly require any action from PWC dealerships, rental shops, or other businesses), but they are likely to be affected nonetheless. For example, allowing PWC use in national parks may lead to increased demand for PWC sales or rentals and decreased demand for alternative watercraft. These shifts in demand may reallocate sales among businesses and may lead to an increase in total revenue for businesses providing tourism-related services. As described in Section 3, the local economy may also experience ripple effects. If businesses that serve PWC users experience an increase in demand for their services, they will most likely increase their purchases of inputs from other sectors of the local economy, including labor. In addition, an increase in revenue for local firms tends to increase regional income. Increases in average household income for the region surrounding the park will also lead to increases in sales for local businesses as local households respond by purchasing more goods (see Appendix A for more detailed information on ripple effects).

Whether these indirect, or secondary, impacts should be included as a change in social welfare in the benefit-cost analysis depends on whether the change in demand or supply in the secondary market results in prices changes (for details, see a benefit-cost analysis textbook such as Boardman et al. [1996]). In general, when the policy change in the primary market (PWC trips to the national park) causes prices to change in the secondary markets, the net change in social welfare from the secondary market should be included in the benefit-cost analysis. If prices do not change in the secondary market, the revenue gains or losses should not be included in the benefit-cost analysis. If the people who would have used PWC in the national park spend their money elsewhere instead, this represents a transfer from one region of the country to another or from one business to another. Although the loss in revenue may hurt the businesses located near the national park, from society's point of view this represents a transfer of income rather than a true cost to society as a whole.

Without more detailed information, it is difficult to predict with certainty whether the proposed alternatives will affect prices for PWC sales. However, NPS believes it is quite possible that the changes in demand that would occur under these alternatives may

result in price changes for PWC-related markets. Thus, losses or gains to tourism-related businesses that may be indirectly affected by the rule are included in the benefit-cost analysis.

4.2 RESULTS FOR CAPE LOOKOUT NATIONAL SEASHORE

Based on the approach and possible impacts outlined above, this section presents the results of the benefit-cost analysis for CALO. The section discusses the groups most directly affected by the alternatives for managing PWC use in the park and several scenarios for the possible levels of impacts. The benefits and costs accruing to these groups, relative to the baseline (where PWC are banned from CALO) are then presented. All results tables in this section show the incremental impacts relative to the baseline projections.

4.2.1 Affected Groups

For the purpose of this study, six major affected groups, listed in Table 4-3, have been identified:

1. PWC users, in particular those who used PWC in CALO prior to the April 2002 ban and those who may wish to use PWC in CALO in the future.
2. Other visitors or potential visitors who may have a different experience at the park if PWC use is reinstated in CALO (canoeists, anglers, swimmers, hikers, boaters, and other visitors).
3. Producers of PWC services (e.g., PWC rental shops, PWC sales shops, restaurants, gas stations, hotels) in the area surrounding CALO who may experience a change in their welfare if PWC use in the park changes.
4. Local residents of the area surrounding CALO.
5. Producers of services to other types of summer visitors (e.g., canoe rentals or powerboat rentals) who may experience a change in their welfare related to the number of PWC users in the park.
6. The general public who may care about the natural resources in CALO even if they do not visit the park.

The impacts on these groups under each alternative are discussed in more detail below.

Alternative A, which reinstates PWC use as managed prior to the ban, has a negative effect on most user groups except for PWC users and the businesses that cater to them. PWC users, PWC

dealerships, and other businesses that provide services to PWC users are expected to experience gains of consumer and producer surplus. Adverse impacts of PWC on anglers, swimmers, canoeists, and other users within CALO relative to the baseline increase

Table 4-3. Incremental Impacts of Alternatives on User Groups

User Group	Alternative A	Alternative B	No-Action Alternative
PWC users	• Consumer surplus is expected to increase as a result of lifting the ban on PWC in CALO.	• Consumer surplus is expected to increase, although somewhat less than for Alternative A because of the additional restrictions on areas in which PWC can be used.	• No change in consumer surplus relative to baseline conditions.
Other visitors or potential visitors: canoe users, anglers, other boaters, swimmers, hikers, and other visitors	• Consumer surplus for current users of CALO is expected to decrease as a result of decreased solitude, increased noise, decreased water quality, and an increase in the risk of accidents involving PWC. • Consumer surplus is expected to decrease for potential visitors who would have visited CALO with a ban on PWC use.	• Consumer surplus for current users of CALO is expected to decrease as a result of decreased solitude, increased noise, decreased water quality, and an increase in the risk of accidents involving PWC, although the magnitude of the decrease may be somewhat smaller than under Alternative A because of the restriction of PWC to special use areas. • Consumer surplus is expected to decrease for potential visitors who would have visited CALO with a ban on PWC use.	• No change in consumer surplus relative to baseline conditions.

(continued)

Table 4-3. Incremental Impacts of Alternatives on User Groups (continued)

User Group	Alternative A	Alternative B	No-Action Alternative
Producers of PWC services: PWC sales shops, PWC rental shops, and other parts of the local economy providing services to PWC users	• Producer surplus may increase for PWC dealerships as a result of a rise in sales and servicing of PWC. • Producer surplus may increase for PWC rental shops, especially for those that formerly provided guided tours that pass through CALO. • Other parts of the local economy such as hotels, restaurants, and gas stations located near CALO may have an increase in producer surplus.	• Producer surplus may increase for PWC dealerships as a result of a rise in sales and servicing of PWC. The increase would likely be smaller than under Alternative A. • Producer surplus may increase for PWC rental shops, especially for those that formerly provided guided tours that pass through CALO. The increase would likely be smaller than under Alternative A. • Other parts of the local economy such as hotels, restaurants, and gas stations located near CALO may have an increase in producer surplus.	• No change in consumer surplus relative to baseline conditions.
Local residents of the area surrounding CALO	• Local residents who use PWC will experience an increase in welfare as a result of reinstating PWC in CALO. • Local residents who do not use PWC may experience a decline in welfare as a result of an increase in noise, a decline in water quality, and an increase in the risk of accidents involving PWC.	• Local residents who use PWC will experience an increase in welfare as a result of reinstating PWC in CALO, although not as much as under Alternative A because of geographic restrictions. • Local residents who do not use PWC may experience a decline in welfare as a result of an increase in noise, a decline in water quality, and an increase in the risk of accidents involving PWC.	• No change in welfare relative to baseline conditions.

(continued)

Table 4-3. Incremental Impacts of Alternatives on User Groups (continued)

User Group	Alternative A	Alternative B	No-Action Alternative
Producers of services for visitors to CALO who do not use PWC	• Producer surplus is expected to decrease slightly because allowing PWC may result in a decrease in demand for other activities in CALO, resulting in decreased demand for the provision of services related to these activities.	• Producer surplus is expected to decrease slightly because allowing PWC may result in a decrease in demand for other activities in CALO, resulting in decreased demand for the provision of services related to these activities.	• No change in producer surplus relative to baseline conditions.
The general public who may care about the natural resources in CALO even if they do not visit	• May experience a decrease in welfare as a result of diminished nonuse values resulting from decreased environmental quality.	• May experience a decrease in welfare as a result of diminished nonuse values resulting from decreased environmental quality, although the change in welfare is expected to be smaller than under Alternative A.	• No change in welfare relative to baseline conditions.

somewhat under this alternative because PWC would be allowed within the park's boundaries. The impact on boaters is ambiguous. Allowing PWC in the park should have negative impacts on other boaters' consumer surplus because of the increased probability of accidents between boaters and PWC users and increased noise levels. However, there is some overlap between people that use PWC and those that use other types of boats. Users of houseboats, powerboats, and other non-PWC boats may enjoy using PWC as part of their boating trips and may experience welfare gains as a result of lifting the ban.

Alternative B is expected to have a similar effect on all park user groups as Alternative A, except some PWC users who may consider the geographic restrictions to be a negative impact. PWC use would be limited to special use areas, with additional restrictions of only operating perpendicular to the shore at flat-wake speeds. NPS estimates that the restrictions proposed under Alternative B will result in lower PWC sales and other PWC-related business revenues increases relative to Alternative A.

The No-Action Alternative, which maintains the ban on PWC, would have no effect on any user group relative to baseline conditions.

4.2.2 Scenarios

To develop estimates of the benefits and costs of the rule under each alternative, NPS used the scenarios described below. NPS considers the No-Action Alternative to be the baseline to which the alternatives are compared. In the baseline, it is assumed that 50 percent of PWC users who used PWC in CALO prior to the ban no longer visit CALO for other recreational activities.

Alternative A

This alternative reinstates PWC use in CALO as previously managed prior to the ban. NPS assumes that PWC sales and rental shops in the region will regain their pre-ban park-related revenues.

Alternative B

The second alternative reinstates PWC use in CALO only in special use areas. Under this alternative, NPS assumes that the

region will regain 90 percent of pre-ban PWC sales and rentals related to the park relative to baseline conditions based on interviews with local businesses. It is also assumed that other local businesses serving PWC users will regain 90 percent of PWC-related revenues relative to pre-ban conditions as a result of the increase in visitation predicted to accompany this alternative.

No-Action Alternative

This alternative would maintain the ban on PWC from CALO. Under this alternative, NPS assumes no incremental change in PWC rentals or PWC sales relative to the baseline.

4.2.3 Costs

As described in Section 2.5, Section 4.1, and Appendix B, PWC use in national parks can be linked to a wide variety of negative impacts. Allowing their use in these parks can therefore harm society in a number of ways. Section 2.5 specifically describes the impacts on natural resources that may result from PWC use within the boundaries of CALO. This section describes how the regulatory alternatives identified above will affect these impacts and assesses the costs of these regulations. Assessing these costs in strictly quantitative (i.e., monetary) terms is not feasible with currently available data; therefore, the costs are largely described in qualitative terms.

Those bearing the largest share of the costs as a result of implementing Alternative A or B would be CALO visitors who do not use PWC and whose park experience is negatively affected by the presence of PWC in the park. The No-Action Alternative is not expected to result in any incremental costs to park users because it continues baseline use patterns. Average annual visitation to CALO was 621,314 people from 2000 to 2004. According to NPS estimates, non-PWC users accounted for over 99 percent of total visitation (see Section 2.2).

“Nonusers” of the park are also likely to bear the costs as a result of PWC regulations in CALO (see Section 4.1 and Appendix B for more details). For example, individuals who do not visit the parks can experience a decline in welfare simply from the knowledge that the natural resources of the park may be degraded by PWC use. Part of this loss may stem from a decreased assurance that

the quality of the park's resources is being protected for the enjoyment of future generations. Therefore, some of the cost categories described below, in particular those associated with the degradation of unique park resources and ecosystems, may accrue in the form of nonuse values.[1]

Aesthetic Costs—Noise and Visibility Impacts

Alternatives that reinstate PWC use will increase noise levels in CALO and reduce the level of natural quiet along portions of the shoreline. They also have the potential to degrade visibility by leading to an increase in the amount of ozone-causing emissions. However, because a large number of motorized boats already operate along the shore in the baseline the incremental negative impacts of allowing PWC in the park are likely to be relatively small.

Alternative A: This alternative has the greatest potential impact relative to the ban because it will allow PWC in all pre-ban areas of CALO. However, noise from other boating activities is prevalent in the baseline. The incremental impact due to PWC use in the park is likely to be negligible to moderate given historically low numbers of PWC relative to other motorized boats. It is expected that, with improved technology, quieter PWC will become the standard, and sounds generated by PWC will decrease over time. NPS anticipates that this alternative would not impair the soundscape (NPS, 2004a).

Alternative B: This alternative will have similar impacts to those under Alternative A, but they will be somewhat smaller then Alternative A because this alternative because it restricts PWC use to special use areas and requires that PWC operate perpendicular to the shore at flat-wake speeds.

[1]The importance of recognizing these values is affirmed in the Organic Act. It established the fundamental purpose of the national park system, which includes providing for the enjoyment of park resources and values by the people of the United States. The mandate applies not just to the people who visit parks—but to all people—including those who derive inspiration and knowledge from afar. Furthermore, through the Redwood Act of March 27, 1978, Congress has provided that when there is a conflict between conserving national park resources and values and providing for enjoyment of them, conservation is to be the primary concern.

No-Action Alternative: This alternative continues baseline management and offers no change in soundscape or visibility relative to baseline conditions.

The restrictions of PWC under Alternative B will provide additional recreation benefits to recreators in the parks, such as canoeists, anglers, and hikers, relative to Alternative A. Noise emissions have been identified as a particular nuisance to non-motorized recreators, such as canoeists and hikers, who tend to place a particularly high value on the tranquility and natural soundscape offered by the parks. Anglers using motorized boats also value the natural soundscape, and while fishing, often operate their boats with quiet electric motors to avoid disturbing fish. Therefore, increasing noise from PWC activity in the parks will negatively impact both motorized and non-motorized recreators.

In addition to generating high noise levels, PWC also emit strong-smelling fumes that can be bothersome to other recreators and reduce visibility. These effects tend to be much more localized than noise emissions. NPS anticipates that visibility impacts from emission increases resulting from allowing PWC under Alternatives A and B will be negligible (NPS, 2004a).

Human Health Costs

PWC emissions contain elevated levels of pollutants such as VOC, CO, PM, NO_X, and HCs, which are potentially damaging to human health. It is very unlikely that historic PWC use in CALO represented a significant health threat to humans; nevertheless, the potential for adverse health effects exists. For example, some of the toxic HCs are potentially harmful even at very low levels of exposure (EPA, 2000a; EPA, 1999a). The continued use of other motorized watercraft in CALO means that, even if PWC were reinstated, the increase in emissions would be relatively small. In summary, the human health costs related to both air and water quality impacts of the regulations are expected to be negligible, depending on the contaminant and the alternative (NPS, 2004a).

Ecosystem Degradation Costs

As discussed in Sections 2 and 4.1 of this report, PWC use has the potential to negatively affect ecosystems and natural habitats in a variety of ways. In the case of national parks, these natural

resources are of particular value to the public. Although PWC use in CALO is not expected to cause widespread ecosystem damage, allowing PWC in the park can nonetheless cause reductions in the welfare of both visitors and nonusers by degrading some of the park's natural resources.

Alternative A: This alternative would have negligible impacts on water quality based on ecotoxicological benchmarks in CALO. In the Environmental Assessment of PWC use in CALO, NPS concluded that this alternative would result in no impairment to water quality (NPS, 2004a).

Alternative B: This alternative would have some negligible negative impacts on water quality. However, these effects are likely to be smaller than under Alternative A. Some ecosystem protection may result from the restrictions banning PWC use in areas other than those adjacent to beach communities.

No-Action Alternative: This alternative would have no impact on water quality and natural resources relative to baseline conditions.

As discussed in Section 2.5 of this report, PWC use has the potential to negatively affect fish and wildlife in a variety of ways. In addition to being a potential nuisance to other recreators, noise from PWC may disturb wildlife.

Although the impacts of reinstating PWC are expected to be limited, potential harm to the park's ecosystems could degrade the experience of park visitors slightly, for example, by decreasing their chances of viewing wildlife in a natural environment. It could also result in welfare losses to individuals across the country who value the park's unique ecosystems and natural habitats, regardless of whether they actually visit the park. That is, any degradation of the park's ecosystems can result in nonuse costs to society.

Safety and Congestion Costs

In addition to environmental costs associated with increases in PWC use, there also may be safety and congestion costs. Between 1990 and 1995, injuries treated in U.S. hospital emergency departments associated with the use of PWC have increased at least four-fold, from approximately 2,860 injuries in 1990 to over 12,000 injuries in 1995, while the number of PWC in

operation increased three-fold during the same time period, from approximately 241,500 in 1990 to 760,000 in 1995. Based on 1992 data, the rate of PWC-related injuries treated in emergency departments was about 8.5 times higher than the rate of injuries from motorboat use injuries treated in emergency departments in the United States (Branche, Conn, and Annest, 1997). Because of the disproportionately large number of injuries associated with PWC use, allowing their use may decrease the safety of park visitors. In addition, the level of congestion is an important factor determining visitor enjoyment. Increases in congestion related to PWC use may therefore have costs to other park users. Safety records over the last 5 years PWC were permitted indicate that there have been 11 PWC-related accidents in CALO (NPS, 2004a).

Alternative A: This alternative has the potential to increase PWC-related accidents in CALO relative to baseline conditions (where there are none because PWC are banned). However, because congestion might decrease in non-NPS waters it is possible that accidents involving PWC could decrease overall because PWC use is distributed over a larger area when CALO becomes available for use.

Alternative B: Like Alternative A, this alternative has the potential to increase safety risks and congestion in CALO, but because PWC use may decrease in non-NPS waters as PWC users switch back to CALO, the overall effect on safety and congestion is unknown. But Alternative B may also concentrate PWC use in a few areas of the park, increasing congestion and the chance for safety risks in these areas.

No-Action Alternative: This alternative would have no effect on safety and congestion in CALO relative to the baseline ban.

Any increase in PWC-related accidents will also increase the costs to NPS associated with medical/rescue operations, relative to baseline conditions.

4.2.4 Benefits

PWC users, as well as some businesses in the local area, may experience welfare gains as a result of the proposed alternative regulations.

Benefits to PWC Users

Two main groups of PWC users may be affected by the regulations: those who used PWC in CALO and those who use PWC in substitute areas outside CALO where PWC users displaced from CALO ride because of the ban in CALO.

For PWC users who rode in CALO prior to the ban or who would have wanted to begin using PWC in the park if use had not been restricted, allowing PWC use in CALO could result in consumer surplus gains.

PWC users who currently ride in alternative areas where displaced riders from CALO may have visited will gain some consumer surplus if these areas are less crowded than under baseline conditions because of reinstating PWC use in CALO. Although no studies were available that examined the impact of congestion on the value of a PWC trip, other recreation demand studies find that congestion lowers the value of a recreation experience (see Appendix B). For PWC users who rode in CALO prior to the ban or who would have wanted to begin using PWC in the park if use had not been restricted, allowing PWC use in CALO could result in consumer surplus gains. To the extent that individuals consider other PWC areas close substitutes, the change in consumer surplus associated with allowing PWC use in the park will be lower.

If each individual's demand curve for riding a PWC in CALO were known (i.e., the number of trips to CALO that would be taken for any given price of a trip), then NPS could add up the gains of consumer surplus for each individual to find the total change in consumer surplus to PWC riders from the proposed management alternatives. Because the demand curve reflects the individual's preferences for available substitute activities and the cost of these activities, measuring the change in consumer surplus from a trip in the park takes into account substitute activities. In this case, NPS does not know the consumer surplus associated with PWC use in CALO, nor does NPS know the riders' next best alternative activities.

To assess the incremental change in consumer surplus for PWC users, NPS used the benefit transfer technique.

To assess the incremental change in consumer surplus for PWC users, NPS used the benefit transfer technique. After conducting an extensive review of the economics literature and consulting with the authors of existing studies, experts in recreation demand analysis at universities, and experts at consulting firms, NPS was unable to locate a study that estimated the consumer surplus for a PWC trip. A review of the recreation literature conducted by Rosenberger and Loomis (2000) found an average value of $31.98 (1996 dollars) per person, per day for riding in motor boats in the entire United States (with estimates ranging from $15 to over $50). Bhat et al. (1998) calculate an average consumer surplus of $9.85 (1998 dollars) associated with motorboating and waterskiing in the Northeast and Great Lakes. Converted to 2005 dollars, the average consumer surplus reported in this study is $11.70. The estimate comes from a travel cost model based on data from the Public Area Recreation Visitors Study (PARVS). The PARVS data was a multi-agency survey that included on-site interviews of recreationists at over 350 sites across the United States between 1985 and 1992. For the benefit transfer, NPS used the value from Bhat et al. (1998) based on the following criteria:

- Waterskiing and motorboating are similar activities to PWC use.
- The region where the data was collected covers an area featuring a climate, natural attractions, and recreational opportunities similar to those of New York, where the study site is located.
- Bhat et al. (1998) was published in a peer-reviewed journal. The authors estimate a travel cost model using data from on-site interviews and only estimate values for activities in a particular region for which at least 100 observations were collected.

Below NPS discusses the estimated impact of each proposed alternative on PWC users.

Alternative A: This alternative would reinstate PWC use in CALO as previously managed. All visitors using PWC in CALO prior to the ban are assumed to regain the full value of their consumer surplus for PWC use in CALO.

Alternative B: This alternative, much like Alternative A, would allow PWC use in CALO but would maintain a ban on PWC use in

all but the special use areas and require PWC to operate at flat-wake speed perpendicular to the shore. These restrictions may cause PWC users who frequent these areas to regain only a portion of their consumer surplus. NPS expects little difference between consumer surplus gains under this alternative and Alternative A.

No-Action Alternative: The No-Action Alternative would maintain the current ban on PWC use in CALO. This would not change regulations relative to baseline conditions and, consequently, would not have any incremental impact on the consumer surplus of any user group.

Using the value of $11.70 for a day of PWC use, NPS provides estimates of possible incremental gains in consumer surplus to PWC users as a result of Alternatives A and B. For the No-Action Alternative, NPS assumes there would be no change in visitation to CALO by PWC users and no measurable change in consumer surplus. Table 4-4 summarizes the projected consumer surplus gains for PWC users in CALO for Alternatives A and B from 2006 to 2015 and the present value (PV) of these gains using both 3 percent and 7 percent discount rates. PV is the value of a future stream of benefits or costs, discounted to current years. Depending on the discount rate and regulatory alternative, the present value of consumer surplus gains for PWC users in CALO from Alternatives A and B from 2006 to 2015 ranges from approximately $382,700 to $521,230.

Table 4-4. Projected Incremental Change in Consumer Surplus for PWC Users Under Alternatives A and B, 2006–2015 (2005$)[a]

	Alternative A		Alternative B	
Year	Change in Number of People Using PWC	Change in Consumer Surplus ($)	Change in Number of People Using PWC	Change in Consumer Surplus ($)
2006	4,586	$53,690	4,128	$48,320
2007	4,724	$55,300	4,251	$49,770
2008	4,866	$56,960	4,379	$51,260
2009	5,012	$58,660	4,510	$52,800
2010	5,162	$60,420	4,646	$54,380
2011	5,317	$62,240	4,785	$56,010

2012	5,476	$64,100	4,929	$57,690
2013	5,641	$66,030	5,076	$59,420
2014	5,810	$68,010	5,229	$61,210
2015	5,984	$70,050	5,386	$63,040
NPV (3%)[b]	NA	$521,230	NA	$469,100
NPV (7%)[c]	NA	$425,230	NA	$382,700

NA = Not available.

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]The economics literature supports a 3 percent discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3 percent discount rate in the valuation of lost natural resource use (61 FR 453; 61 FR 20584).

[c]Office of Management and Budget (OMB). 2002. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 22, 2002.

Uncertainty

The estimates of consumer surplus gains to PWC users are uncertain for a variety of reasons. Some of the main sources of uncertainty are as follows:

- The estimates of the number of PWC users expected to visit CALO under each of the alternatives are uncertain, as are the projections of future PWC use.
- The actual consumer surplus associated with PWC use in CALO may be different from the value used in the analysis. The value used in the analysis is based on studies of riding in motor boats and waterskiing.
- The values in Table 4-4 may overestimate true gains under Alternative B because of assumptions about the consumer surplus of PWC users who ride in the park. In the analysis of Alternative B, PWC users who use PWC in CALO may be inconvenienced by the additional restrictions. These requirements may decrease the consumer surplus associated with using a PWC in CALO.
- The 1996 EPA Marine Engine Rule (see Section 2.2.4) may result in lower PWC use if the cost of new machines increases. If fewer riders would visit the park, the incremental consumer surplus gains associated with Alternative A or B would be lower.

Benefits to the Local Area Businesses

If PWC use increases as a result of the regulation, then the suppliers of PWC rentals, sales, and service will be directly affected. In addition, lodging establishments, restaurants, gas

stations, and other businesses that serve PWC riders could experience an increase in business from the regulation. The following section describes the approach used to develop quantitative estimates of these impacts and reports the results of the cost analysis for local area businesses.

PWC Sales, Rental, and Associated Businesses Serving CALO. As described in Section 2.6, NPS identified one firm that rents PWC and four sales/service shops in the CALO area. It was assumed that all five firms would be affected by changes to PWC regulations in CALO even though many of the firms mentioned alternative locations for PWC use in the area. As described in Section 3.1, NPS estimated the changes in visitation and local business revenues that would result from each of these alternatives. Table 3-4 summarizes the revenue gains estimated for local businesses.

Lodging Establishments, Restaurants, Gas Stations, and Other Businesses. Purchases made by PWC users contribute to total economic activity in the area surrounding CALO. It is possible that localized impacts on tourism-related businesses located near CALO will occur if PWC regulations result in increased visitation to the recreation area. Lodging establishments, restaurants, gas stations, and other businesses that serve PWC riders are not likely to experience a large increase in business under any of the alternatives.

NPS does not expect the No-Action Alternative to result in revenue gains to firms relative to the baseline. Based on the existing data and interviews with local businesses, NPS calculated revenue gains under Alternatives A and B for the following business categories: PWC rentals, PWC sales, lodging, restaurants, supermarkets, gasoline, local transportation, admissions/fees, clothing shops, sporting goods shops, and souvenir/retail shops. These revenue gains are presented in Table 3-4.

PWC sales are expected to gain $910,040 under Alternative A and $606,690 under Alternative B. This category represents over 90 percent of the total expected gains for businesses. Lodging establishments are projected to gain $14,070 and $11,250 in revenues, while restaurants and bars are projected to gain

$13,380 in revenues under Alternative A and $10,700 in revenues under Alternative B, respectively. PWC rentals are expected to gain $11,780 under Alternative A and $10,600 under Alternative B. The remaining business categories (souvenirs, supermarkets, gasoline and oil, admissions/fees, clothing, sporting goods, other vehicle expenses, camping fees, and local transportation) are expected to gain a total of $20,580 to $25,710, depending on the alternative selected.

To translate increased PWC revenue into producer surplus gains for purposes of benefit-cost analysis, NPS used estimates of the increase in revenue associated with the rule and the return-on-sales measure for the Standard Industrial Classification (SIC) code provided by Dun & Bradstreet (D&B). The use of this profit margin only approximates gains in producer surplus. Producer surplus captures the difference between marginal costs and marginal revenue, while return on sales contains other measures reflecting fixed costs, taxes, and/or accounting conventions rather than measures of variable profits. For this reason, the use of D&B accounting profit margin data may understate producer surplus gains.

The profit ratios presented in Table 4-5, net profit after tax divided by sales, come from D&B (2001).[1] The upper quartile profit ratio for sales shops is 4.6 percent and the lowest quartile is 0.6 percent. The upper quartile profit ratio for rental shops is 8.7 percent and the lowest quartile is –3.4 percent. However, none of the shops that NPS interviewed for other parks indicated that they had a negative profit margin. Therefore, NPS used the median profit ratio (3.9 percent) as the low value in this analysis.

[1]D&B data for North American Industry Classification System (NAICS) codes are not currently available. Therefore, NPS used the comparable SIC code 5571 (Motorcycle Dealers) as defined by the U.S. Census (i.e., SIC 5571, Motorcycle Dealers) for PWC dealerships. For rental shops, NPS used SIC code 7999 (Amusement and Recreation NEC).

Table 4-5. Profit Ratios Used for Calculating Producer Surplus Losses

		Profit Ratios	
	SIC	Bottom Quartile	Upper Quartile
PWC Rentals	7999	3.90%	8.70%
PWC Sales	5571	0.60%	4.60%
Lodging	7011	1.30%	14.70%
Restaurants and Bars	5812	0.60%	7.50%
Grocery Stores	5411	0.40%	3.00%
Gas and Oil	5541	0.10%	3.10%
Souvenir Shops and Other Retail Establishments	5947	1.10%	9.90%

For businesses in the CALO region, estimated producer surplus gains associated with imposing the regulatory alternatives (relative to baseline conditions) are presented in Table 4-6.[1] Total producer surplus gains expected under Alternative A range from $6,380 to $47,770. Under Alternative B, estimated total producer surplus gain ranges from $4,410 to $32,750. The largest increase in producer surplus occurs in the PWC sales/services category, with increases ranging from $3,640 to $41,860 across these alternatives. Producer surplus gains for other affected categories range from $0 to

Table 4-6. Changes in Producer Surplus in the First Year Resulting from PWC Use Management Alternatives in CALO (2005$)[a]

	Alternative A		Alternative B	
	Low	High	Low	High
PWC Rentals[b]	$460	$1,020	$410	$920
PWC Sales/Service	$5,460	$41,860	$3,640	$27,910
Lodging	$190	$2,110	$150	$1,690
Restaurants and Bars	$80	$1,000	$60	$800
Groceries/Take-Out	$20	$160	$20	$130
Gas and Oil	$10	$160	$0	$130
Souvenirs and Other Retail	$160	$1,460	$130	$1,170

[1]Estimated producer surplus losses in future years have a similar distribution across industries.

Total	**$6,380**	**$47,770**	**$4,410**	**$32,750**

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]Due to the distance of the one identified PWC rental shop from CALO, NPS assumed there would be no impacts on PWC rentals for any of the alternatives.

$2,110, depending on the business category, the alternative, and the profit ratio used. Under the No-Action Alternative, there are no projected gains in producer surplus because there is no change relative to baseline.

Table 4-7 summarizes the estimated change in producer surplus for the period from 2006–2015. The present value of incremental gains in producer surplus for Alternative A is between $61,960 and $463,790 with a 3 percent discount rate and $50,540 to $378,360 with a 7 percent discount rate. For Alternative B, the present value of producer surplus gain is estimated to be $42,790 to $317,910 using a 3 percent discount rate and $34,910 to $259,360 using a 7 percent discount rate. There is no change in producer surplus under the No-Action Alternative.

Uncertainty

A number of factors will affect local business revenue and producer surplus gains associated with the proposed alternatives. Important factors include the uncertainty surrounding the baseline visitation projections as described in Section 2.2, uncertainty concerning the estimation of output increases as described in Section 3.3.8, and the use of national average accounting profit ratios to approximate producer surplus gains to individual local businesses.

Table 4-7. Changes in Producer Surplus Resulting from Reinstating PWC Use in CALO, 2006–2015 (2005$)[a]

	Alternative A		**Alternative B**	
Year	**Low**	**High**	**Low**	**High**
2006	$6,380	$47,770	$4,410	$32,750
2007	$6,570	$49,200	$4,540	$33,730
2008	$6,770	$50,680	$4,680	$34,740
2009	$6,970	$52,200	$4,820	$35,780
2010	$7,180	$53,770	$4,960	$36,850

2011	$7,400	$55,380	$5,110	$37,960
2012	$7,620	$57,040	$5,260	$39,100
2013	$7,850	$58,750	$5,420	$40,270
2014	$8,090	$60,510	$5,580	$41,480
2015	$8,330	$62,330	$5,750	$42,720
PV (3%)[b]	**$61,960**	**$463,790**	**$42,790**	**$317,910**
PV (7%)[c]	**$50,540**	**$378,360**	**$34,910**	**$259,360**

[a]All impacts were rounded to the nearest $10. Columns may not sum to totals due to rounding.

[b]The economics literature supports a 3 percent discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3 percent discount rate in the valuation of lost natural resources use (61 FR 453; 61 FR 20584). Although the welfare impacts in this case are for private goods, the 3 percent discount rate was used to be consistent with discounting of other impacts in this report.

[c]Office of Management and Budget (OMB). 2002. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 22, 2002.

NPS Enforcement Costs. As a result of lifting the ban on PWC use in CALO, costs are expected to be incurred by taxpayers to support an increase in enforcement efforts by park staff. Although NPS expects that additional staff may be required under Alternatives A and B relative to the baseline, the number of staff (if any) that would be hired is uncertain.

Consequently, NPS does not quantify enforcement costs associated with the implementation of Alternatives A and B. The No-Action Alternative, which continues baseline conditions, will not result in any additional enforcement costs for CALO.

4.3 SUMMARY

The No-Action Alternative continues baseline conditions. Under this alternative, all PWC use would remain prohibited from the park. Alternative B would permit PWC use with certain restrictions, and Alternative A would permit PWC use as previously managed in the park (pre-ban). The benefits of any alternative are measured relative to the baseline conditions, which are represented by the No-Action Alternative. Therefore, there are no incremental benefits associated with the No-Action Alternative. The primary beneficiaries of Alternative A or B would be the park visitors who use PWC and the businesses that provide services to PWC users such as rental shops, restaurants, gas stations, and hotels. Additional beneficiaries include individuals who use PWC outside the park where PWC users displaced from the park may decide to ride if PWC use within the park were prohibited.

Benefits accruing to individual PWC users are called consumer surplus gains, and those accruing to businesses are called producer surplus gains. Consumer surplus measures the net economic benefit obtained by individuals from participating in their chosen activities, while producer surplus measures the net economic benefit obtained by businesses from providing services to individuals. These benefits, projected over a 10-year horizon, are summarized in Table 4-8. Over the period 2006 to 2015, the present value of consumer surplus for PWC users is expected to increase by $382,700 to $521,230 and producer surplus is expected to increase by $34,910 to $463,790 if PWC use in the park is reinstated, depending on the assumptions used.

As with the benefits described above, the costs of any alternative are measured relative to the baseline conditions, which are represented by the No-Action Alternative. Therefore, there are no incremental costs associated with the No-Action Alternative. The primary group that would incur costs under Alternative A or B is park visitors who do not use PWC and whose park experiences would be negatively affected by PWC use within the park. At CALO, non-PWC uses include boating, canoeing, fishing, and hiking. Additionally, the public could incur costs associated with impacts from Alternative A or B to aesthetics, ecosystem protection, human health and safety, congestion, nonuse values,

and enforcement. However, these costs could not be quantified because of a lack of available data.

Table 4-8. Present Value of Projected Incremental Benefits Under Alternatives A and B (in thousands of 2005$), 2006–2015

	PWC Users	Businesses	Total
Alternative A			
Discounted at 3%[a]	$521.2	$62.0–$463.8	$583.2–$985.0
Discounted at 7%[b]	$425.2	$50.5–$378.4	$475.8–$803.6
Alternative B			
Discounted at 3%[a]	$469.1	$42.8–$317.9	$511.9–$787.0
Discounted at 7%[b]	$382.7	$34.9–$259.4	$417.6–$642.1

[a]The economics literature supports a 3 percent discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3 percent discount rate in the valuation of lost natural resources use (61 FR 453; 61 FR 20584). While the welfare impacts in this case are for private goods, the 3 percent discount rate was used to be consistent with discounting of other impacts in this report.

[b]Office of Management and Budget (OMB). 2002. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 22, 2002.

Because the costs of the alternatives are not quantified, the benefits presented in Table 4-8 represent the quantified net benefits of Alternatives A and B. As noted above, these net benefits do not account for the costs of enforcement; the costs to non-PWC users; or those costs relating to aesthetics, ecosystem protection, human health, and safety, congestion, or nonuse values as a result of a lack of available data. Therefore, these net benefit estimates do not reflect all costs. If all costs could be incorporated, the indicated net benefits for each alternative would be lower.

From an economic perspective, the selection of Alternative B as the preferred alternative is considered reasonable because certain costs could not be quantified in the net benefits presented above. Those costs, relating to non-PWC use, aesthetics, ecosystem protection, human health and safety, congestion, or nonuse values, would likely be greater for Alternative A than for Alternative B. Further inclusion of these un-quantified costs could reasonably result in Alternative B having the greatest level of net benefits due to the restriction of PWCs to operating at flat-wake speeds perpendicular to the shore at special use areas only that

would be implemented under this alternative. Therefore, based on these factors, Alternative B was considered to provide the greatest level of net benefits.

5 Small Entity Impact Analysis

Alternatives A and B are expected to have positive effects on small PWC-related businesses in the vicinity of CALO relative to baseline conditions, while the No-Action Alternative has no incremental impacts.

Changes to the management of PWC use in national parks potentially affect the economic welfare of a number of businesses, large and small. However, small entities may have special problems in complying with such regulations. The RFA of 1980, as amended in 1996, requires special consideration be given to these entities during the regulatory process.

To fulfill these requirements, agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. This section assesses the potential for PWC regulations in CALO to affect small businesses. Expected changes in revenues across firms and regional economic impacts are discussed in Section 3, and expected changes in producer surplus are discussed in Section 4.

5.1 IDENTIFYING SMALL ENTITIES

As described in Sections 2.6 and 3.1, NPS attempted to identify the firms in the region surrounding CALO that would experience the most significant impacts as a result of PWC regulations in CALO. Small entities potentially affected by the regulations include companies providing PWC rentals, sales, and service; lodging establishments; restaurants; grocery stores; and other retail businesses. The minimal expected changes in visitation to the area as a result of implementing Alternative A or B suggest that there will be no noticeable regional impacts on restaurants, grocery stores, or other retail businesses. It is possible that these tourism-related industries may experience localized positive

impacts in communities located adjacent to CALO, but any impacts are expected to be small relative to the impacts estimated for businesses that provide PWC sales, rentals, and service. The impacts on the PWC-related businesses considered are believed to be representative of the upper bound of impacts that would be experienced by local businesses under Alternative A or B. Under the No-Action Alternative no incremental impacts are expected for small businesses because it maintains baseline management conditions under which PWC were banned from CALO in April 2002.

Based on annual sales, NPS defined four of the five directly affected firms identified as small businesses for this analysis. The fifth local firm is a large business.

NPS contacted four PWC sales/service shops and one PWC rental shop located in communities near CALO. Three of the businesses are located in Carteret County, and two are located in neighboring Craven County. NPS interviewed these businesses regarding the characteristics of their PWC business and the impacts of regulation. The Small Business Association's (SBA) general size standard definitions for PWC-related industries (NAICS 532292—Recreational Goods Rental[1] and NAICS 441221—Motorcycle Dealers[2]) classify companies with annual sales less than or equal to $5 million as small. Based on interviews and data reported by *infoUSA* (2002), three potentially affected companies have less than $500,000 in annual sales, one has annual sales between $1 million and $5 million, and one has annual sales over $5 million. Using this criterion and sales data, four of the five firms are classified as small businesses. The firm with annual sales greater than $5 million has stores in both New Bern and Kinston. The Kinston location also sells greenhouses and has annual sales between $10 million and $20 million. Considering the annual sales from the New Bern location only, NPS estimated that this store and the four firms identified as small businesses had a total of $2.21 million in annual revenue in 2000.

[1]This industry comprises establishments primarily engaged in renting recreational goods, such as bicycles, canoes, motorcycles, skis, sailboats, beach chairs, and beach umbrellas.

[2]This industry comprises establishments primarily engaged in retailing new and/or used motorcycles, motor scooters, motor bikes, mopeds, off-road all-terrain vehicles, and PWC or retailing these new vehicles in combination with repair services and selling replacement parts and accessories.

5.2 ASSESSMENT

Do the management alternatives considered have a significant negative impact on a substantial number of small entities?

Alternative A: No

Alternative B: No

No-Action Alternative: No

After considering the economic impacts of the PWC regulations in CALO on small entities, NPS concludes that none of the management alternatives will have a significant negative impact on a substantial number of small businesses. Alternatives A and B will have a positive impact on small businesses relative to the baseline scenario, under which PWC were banned from CALO in April 2002. The No-Action Alternative will not have an impact on small entities because it will not result in a change from baseline conditions. NPS made the determination that these management alternatives would not have a significant impact on small entities using RFA implementation guidance provided by other agencies (National Marine Fisheries Service [NMFS], 2000; EPA, 1999b; SBA, 2003) and provides the following factual basis for this determination:

- This rule is not expected to reduce any of the area businesses' profit margins or reduce the competitiveness of the PWC rental and retail businesses.
- None of the alternatives is expected to cause any small businesses in the CALO area to close.
- NPS projects small increases in revenue relative to the baseline for firms selling PWC and renting PWC to CALO visitors under Alternatives A and B.
- NPS projects slightly higher overall levels of revenue for other businesses (including hotels, restaurants, grocery stores, gas stations, and souvenir shops) in the CALO region relative to the baseline under Alternatives A and B.
- NPS projects no change in revenue for local small businesses relative to baseline conditions under the No-Action Alternative.

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Appendix A: Economic Impact Analysis

Expenditures made by visitors to national parks have a variety of economic impacts on the region where the park is located. For instance, tourists contribute to sales, profits, jobs, tax revenues, and income in a region. The most direct effects are felt within the primary tourism sectors: lodging, dining, transportation, entertainment, and retail trade. However, when indirect effects are included, almost all sectors of the economy are affected by tourism. This occurs because spending by tourists on the primary tourist sectors leads those sectors to purchase inputs into their production process from other industries, which then purchase more inputs themselves and so on. In addition, as local household income rises because of the impact of tourism, these households purchase more goods and services from many different industries. This leads to higher incomes for households deriving income from these other industries, which causes them to purchase more goods and services as well. These feedback effects continue indefinitely, but become smaller and smaller in each round as a result of leakage because not all income is spent within the regional economy. These effects on household spending are known as induced effects.

A simple example from Stynes (2000) illustrates this point. Assume a region attracts an additional 100 tourists, each spending $100 per day. The direct impact of this increase in tourism is $10,000 per day in new spending. If sustained over a season of 100 days, the region would experience an increase in sales of $1 million. This spending would primarily take place in the lodging, dining, entertainment, and retail sectors in proportion

to how each visitor spends his/her $100. Not all of the value of this spending can be assumed to accrue within this region because the cost of goods made in other regions should not be included as a direct sales effect in the local area. For example, gasoline purchased by tourists for $1.50 per gallon should not be included as a local spending impact of $1.50 per gallon. Instead, only the retail margin on the gasoline can be considered a direct effect of tourism spending. The margins on gasoline are relatively small. Assuming a retail margin of 12 percent suggests that the direct impact of spending on gasoline to the local area is only about 18 cents per gallon. Wholesale margins are also included for wholesalers located within the region of interest.

Returning to the example above, perhaps 30 percent of the million dollars in direct spending would leak out of the area to cover the costs of goods purchased by tourists that were produced outside the region. The remaining $700,000 increase in direct sales might yield $350,000 in income within tourism-related industries and support 20 jobs directly linked to tourism. Tourism industries tend to be labor intensive, translating a relatively high proportion of sales into income and jobs.

The tourism industry buys goods and services from other industries located in the area to provide the goods and services offered to tourists. For example, changes in sales, jobs, and income in the linen industry (an industry supplying products to hotels) will result from changes in hotel sales. Also, as mentioned above, this industry is typically very labor intensive. Therefore, most of the $350,000 in income will be paid as wages and salaries to tourism industry employees. As a result of this increase in income, these employees will spend more in the local region for an array of household products and services. Assuming a sales multiplier of 2.0 to indicate that each dollar of direct sales generates another dollar of secondary sales implies that the $700,000 in direct sales within the region leads to a $1.4 million increase in regional sales as a result of the additional tourists visiting the area. These secondary sales create additional income and employment in the region, with the estimated impact dependent on the multipliers for each particular region. Assume in our case that the total impact of the increase in tourism after

applying multipliers is $1.4 million in sales, $650,000 in income and 35 jobs.

Although hypothetical, the numbers used in this example are fairly typical of those used in a tourism economic impact study. Through indirect and induced effects, changes in tourist spending can affect almost every sector of the economy to some extent. The magnitude of these effects depends strongly on the extent to which businesses and households in the region purchase goods and services from local suppliers as well as how much household income is affected by the changes in spending. When a large employer closes a plant, the entire local economy may be negatively affected as retail stores close and leakages of spending from the region increase as consumers go outside the region for more of their goods and services. Similar effects in the opposite direction are observed when a new facility opens and there is a significant increase in household income (Stynes, 2000).

In addition to simply estimating the total regional impact, more detailed studies identify the sectors that receive the direct and secondary effects. They may also identify distinct market segments and identify differences in spending and impact between these subgroups. This information is sometimes used to target marketing efforts towards tourists with particular characteristics that are likely to lead to the largest economic impact per marketing dollar. It may also be used simply to better understand the distribution of impacts and to gain a better measure of the expected effects of a change in regional spending. Effects on tax revenues may also be examined by applying local tax rates to changes in sales and income.

The economic impacts resulting from a change in spending are typically measured by

- estimating the change in the number and types of visitors to the region due to the proposed change in policy,
- estimating average levels of spending (often within market segments) of visitors in the local area, and
- providing the estimated change in direct spending as input into a regional economic model to determine secondary effects.

Estimates of changes in visitor activity usually come from a demand model or professional judgment about the changes in

visitation likely to take place. This step is often the weakest link in tourism impact studies because most regions do not have accurate counts of visitors, let alone models for predicting changes in visitation (Stynes, 2000).

Spending averages are usually derived from visitor surveys or may be adapted from other similar studies. Because of differences in visitors, these data are often provided for different segments of the visitor population due to variations in spending patterns based on whether visitors stay overnight, the accommodations they choose, the type of transportation they are using, and other characteristics of their stay.

One of the primary methods used to estimate the secondary economic impacts of a particular action or policy is to apply an input-output (I-O) model. I-O models are mathematical models that describe the relationship between sectors in a region's economy. Regional I-O models are commonly used to estimate the benefits or costs of an event on the economy of a given region. These models are used to estimate linkages among sectors of the economy such that an event directly affecting one sector of the economy can be traced through the impact on the entire regional economy. This approach permits estimation of both the direct impacts in the affected sector as well as indirect impacts that occur as the change in spending by the directly affected industry works its way through the economy. Based on production functions estimating the inputs that each industry must purchase from every other industry to produce their output, these models predict flows of money between sectors. These models also determine the proportion of sales that end up as income and taxes. Multipliers are estimated from I-O models based on the estimated recirculation of spending within the region. The higher the propensity for households and firms within the region to purchase goods and services from local services, the higher the multipliers for the region will be. A number of important assumptions are involved in using I-O models. Some of the basic assumptions include the following:

- **Constant Returns to Scale.** Each industry's production function is assumed to have constant returns to scale. This means that, to produce additional output, all inputs increase proportionately (i.e., if output in an industry were to double, then that industry would double its use of all

inputs). Because labor is one of the inputs into production, this implies that jobs will change in exactly the same proportion as output.

- **No Supply Constraints.** Supplies are unlimited. All industries have access to unlimited quantities of raw materials at a constant price with output limited only by demand.
- **Fixed Commodity Input Structure.** This assumption implies that price changes do not cause a firm to purchase substitute goods. This structure assumes that changes in the economy affect the industry's output but not the mix of inputs it uses to make its products.
- **Homogeneous Sector Output.** The proportion of all the commodities produced by an industry will remain the same, regardless of total output. An industry will not increase the output of one product without proportionately increasing the output of all its other products.
- **Industry Technology Assumption.** This assumption is important when data are collected on an industry-by-commodity basis and then converted into industry-by-industry data. It assumes that an industry uses the same technology to produce all of its products. In other words, an industry has a primary product and all other products are by-products of the main product.
- **Identical Firms.** All firms in a given industry employ the same production technology and produce identical products.
- **Model Parameters.** The various model parameters are accurate and represent the current year. These models rely on the national system of accounts to generate model parameters based on standard industrial classification codes and various federal government economic censuses. They are usually at least a few years out-of-date, although this is not usually a major problem unless the region has changed significantly.
- **Induced Effects.** Multiplier computations for induced effects assume that jobs created by additional spending are new jobs involving local households. The induced effects of new spending are calculated assuming linear changes in household spending with changes in income.

These assumptions are necessary to estimate an economic impact model using a typical regional I-O model. However, these assumptions lead to several limitations as noted by Hamilton et al. (1991); Coughlin and Mandelbaum (1991); and Stabler, Van Kooten, and Meyer (1988), among others. Most of these issues apply to alternative models as well and should be considered in interpreting the results of economic impact analyses in general.

Some of the biggest limitations associated with this type of analysis are discussed below.

First, all production inputs have an associated opportunity cost. Thus, these opportunity costs should be included in the net benefits calculation, although this is often not considered in an economic impact analysis. Net benefits equal impacts less opportunity costs. In the case of full employment, perfect resource mobility, and absence of scale economies, benefits of a policy, action, or project would be zero because all factors employed as a result could have received the same return without the policy, action, or project in alternative uses. Typically, applications analyzing regional economic analysis assume that there is not full employment and complete mobility in the region being analyzed, but the change in net benefits will still be reduced if opportunity costs are considered.

Another issue is that multipliers estimate short-term changes, ignoring a regional economy's long-term adjustments. Thus, most of the economic effects identified in economic impact analysis are likely to be only transitory as the regional economy adjusts to the change. For example, if jobs are lost in a region because of new regulations, some of this reduction will be temporary because some of the workers whose jobs were eliminated will find new jobs in the region.[1]

Also, if some workers relocate in response to a change in the regional economy, then it is not entirely clear who should be counted in the region when calculating the benefits and costs associated with a change. For example, a new project located in a particular region may attract resources from outside the region. It is not clear that income to these immigrant resources should be counted as regional benefits of the project because people originally from the region do not benefit. However, I-O models typically make no distinction between jobs and sales, for example, going to those people already within the region and benefits going to those people outside the region.

[1]Some workers may not find jobs within the region, even in the long run. The loss of workers who leave for jobs in other regions may tend to slow the region's growth, but such restructuring ultimately improves national economic performance by redistributing resources to their most efficient use.

Furthermore, applying multipliers is difficult if industries will move to different points on their cost curves as a result of the change and there are economies or diseconomies of scale. Because I-O models are based on fixed coefficients, they are not able to capture these impacts. These models assume that there are no supply constraints such that industries will not change their relative purchases from other sectors. This requires excess regional production capacity and excess regional labor so that use of these resources can be increased without a change in prices. In many areas, this is unlikely to be the case. Instead, increasing scale may lead to an increase in the price of labor and other resources and may cause a change in the mix of inputs used for production. It may also lead to the use of a different proportion of inputs being purchased from outside the region, which will affect the estimated change in final demand for regional output.

Some additional difficulties with applying regional multipliers include the following:

- multipliers are based on political boundaries (e.g., counties, states) instead of economic areas;
- multipliers may not be constant over time;
- different production functions for different activities are lumped together; and
- information on the relationships between producers in a region is lacking, which makes constructing an accurate set of multipliers very difficult.

Despite these caveats on the use of multipliers, regional I-O models are still considered the best way currently available to cost-effectively estimate the regional impacts of a change that will affect the local economy.

Appendix B: Social Benefits and Costs of Personal Watercraft Restrictions

The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case the regulation of PWC use in national parks. That is, it assesses whether the action generates benefits to society (gains in social welfare) that are greater than the costs (losses in social welfare). The following sections provide detailed descriptions of the range of social benefits and social costs that may result from PWC restrictions and discuss the ways in which these benefits and costs can be conceptualized and measured.

B.1 SOCIAL BENEFITS OF PWC RESTRICTIONS

PWC use in national parks may be associated with a number of negative impacts on environmental resources and ecosystems. One result of any negative impacts that occur is that they impose welfare losses on individuals who value the parks' environmental systems. The benefits of PWC restrictions can therefore be thought of and measured as the reduction in these losses to society. In addition, PWC use can negatively affect society in ways that are not directly related to the environment; therefore, the benefits of PWC restrictions must also include reductions in these nonenvironmental losses. Both broad categories of benefits—environmental and nonenvironmental—are discussed in more detail below.

B.1.1 Environmental Benefits

The use of PWC may have adverse impacts on the aesthetic qualities of the park, on human health, and on the park's ecosystems. The benefits associated with avoiding these impacts are described below.

Aesthetic Benefits

Among the largest and most directly damaging impacts associated with PWC use in national parks are its effects on the aesthetic qualities of park air and specifically the park soundscape. The natural soundscape is considered a natural resource of the park, and NPS attempts to prevent or minimize unnatural sounds that adversely affect the natural soundscape. National parks are especially valued for their pristine and undisturbed environments, which are often experienced by visitors through natural vistas and through the relative absence of visible or audible human activity (NPS, 2000c). The improvement or preservation of these aesthetic qualities, either in the form of reduced noise pollution or improved visibility, is therefore a potentially important source of benefits from reducing PWC use.

Noise Reduction. Perhaps the most noticeable and intrusive aspect of PWC is the level of sound they emit during normal operation. PWC have been measured to emit 65 to 105 decibels (dB) per unit, which may disturb visitors on the land and on the water. Noise limits established by NPS require vessels to operate at less than 82 dB at 82 feet (from the shoreline). The amount of noise from a PWC can vary considerably depending on its distance from another park visitor and whether it is in the water or in the air. Noise dissipates by 5 dBs for each doubling of distance from a 20-foot circle around the source and a PWC that is airborne is 15dBA louder than one that is in the water (Komanoff and Shaw, 2000). To put these noise-level estimates into perspective, Table B-1 also compares them with those of other familiar sounds.

PWC users tend to operate close to shore, to operate in confined areas, and to travel in groups, making noise more noticeable to other recreationists. Noise impacts from PWC use are caused by

frequent changes in pitch and loudness due to rapid acceleration, deceleration, and change of direction. PWC noise intrudes in

Table B-1. Comparative Noise Emissions

Source	Decibel Level
Firearms	140
Motorcycle	90–110
Snowmobiles	73–100
Vacuum cleaner	70
PWC	65-105
Normal conversation	60
Normal breathing	10

Sources: League for the Hard of Hearing, 2000; Overseas Marketing Group (OMGSIC), 2000.

otherwise quiet soundscapes, such as in secluded lakes, coves, river corridors, and backwater areas. Also, PWC use in areas where there are nonmotorized users (such as canoeists, sailors, and kayakers) causes conflicts between users.

Those who are most likely to benefit from reductions in PWC-related noise pollution in national parks are other park visitors and recreators, in particular those engaged in recreational activities that take place by the water, such as fishing, hiking, birdwatching, canoeing, kayaking, and swimming.

Several studies have shown that noise from motorized vehicles diminishes the recreational experience of other users. Several studies have found disamenities associated with various forms of mechanized recreational activities or other “technology-related” noises in recreation areas (Beal, 1994; Ivy, Stewart, and Lue, 1992; Bury and Luckenbach, 1983; Baldwin, 1970; Bury, Wendling, and McCool, 1976; Dunn, 1970; Lucas and Stankey, 1974; O’Riordan, 1977; Sheridan, 1979; Wagar, 1977).

Relatively few studies have specifically estimated the (negative) value of noise externalities on other recreators. One exception is a recent analysis conducted by the Federal Aviation Administration (FAA) to estimate the benefits of a regulation to restrict commercial air tours in Grand Canyon National Park

(GRCA) (FAA, 2000). Using visitor-day value estimates from existing studies ranging from $37 to $92 (for backcountry, river, and other users of the park), the analysis assumed that these visitor-day values would be reduced in relation to the how much aircraft noise interfered with the enjoyment of GRCA. Information about how aircraft noise affected different recreators was provided by a separate survey study of GRCA visitors. The survey found, for example, that for backcountry visitors 21 percent were "slightly" affected and 2.5 percent were "extremely" affected by the aircraft noise. In the FAA analysis, visitor value-days were assumed to be reduced by 20 to 80 percent depending on the percentage of respondents who indicated that their enjoyment of the park was "slightly," "moderately," "very," or "extremely" affected by the noise.

Another example of such a study that focuses specifically on the noise impacts of PWC is one that has examined the losses that PWC users impose on other beach recreators (Komanoff and Shaw, 2000). This study assumed that an average beach day (per person) is worth between $10 for a popular beach and $30 for a secluded one and that each 10 dB increase in background noise decreases these values by 10 percent. The assumptions about the size of the decrease in value from increases in noise come from studies on the increased property values for houses in quiet neighborhoods. Assuming also that each 1 dB noise level increment reduces the value of a beach day by 1 percent, the study found that beachgoers suffer an average loss in recreation value of between $0.50 and $7.40 per jet ski cluster (1.6 jet skis over the course of a day) per person per day.

Other evidence regarding the noise-related losses imposed by PWC can be gleaned from studies that have examined the effects of congestion on recreation values. In these studies, congestion is often measured as the number of encounters with other recreators, which may be thought of as being roughly equivalent to hearing the sound of PWC. For example, in a study of backcountry recreators in the Caribou-Speckled Mountain Wilderness in Maine, Michael and Reiling (1997) found that weekend visitors experienced losses of $22.3 (in 1990 dollars) per visit if they encountered more groups than expected.

Visibility Improvements. Several studies by the NPS and others have demonstrated the importance of visual air quality for visitors' (and nonvisitors') enjoyment and appreciation of national parks. Nevertheless, visual air quality has been and continues to be threatened at many national parks across the country. Emissions from PWC in these parks are one of many potential (albeit, a relatively small) sources of these visibility impairments.

Although visibility effects can be characterized and measured in several different ways, "regional haze," which uniformly reduces visual range and therefore impairs the appreciation of natural vistas, has been a particular source of concern. The primary contributors to regional haze and visibility impairments in general are small particles (particulate matter or PM) in the atmosphere that scatter and absorb light. There are several different sources and types of particles in the environment; however, sulfates (and to a lesser extent nitrates), primarily from the combustion of fuels, are the largest contributors to visibility reduction, especially in the eastern portions of the U.S. (Malm, 1999). Nationwide, the largest sources of sulfur dioxide emissions that contribute to sulfates in the atmosphere are power plants and other industrial sources. Mobile sources, such as cars, trucks, and buses (and PWC), account for the largest portion of NO_X emissions, which contribute to nitrates.

Emissions factors per hour are not available for PWC but because PWC are powered by the same type (two-stroke) of engine as snowmobiles, snowmobile emissions factors may serve as a reasonable proxy. Table B-2 compares typical emissions rates for snowmobiles and other vehicles for NO_X and PM. These are the pollutants that are the most likely contributors to visibility impairments from PWC emissions. These emissions rates vary greatly across types and uses of these vehicles; however, the table shows that PM emissions for snowmobiles are particularly high relative to automobiles. The California Air Resources Board found that a 7-hour ride on a PWC powered by a conventional two-stroke engine produces the same amount of smog-forming emissions as over 100,000 miles driven in a modern passenger car. It should also be noted, however, that automobiles account for a very small portion of PM emissions nationwide.

The estimates in Table B-2 suggest that PWC can be a source of visibility impairment in national parks, but their contribution to overall levels of regional haze in these areas is likely to be negligible. Nevertheless, in high-use areas and periods, they may negatively affect visual air quality in a noticeable way.

Table B-2. Comparative Emissions Factors for Snowmobiles and Other Vehicles: NO_X and PM

	NO_X	PM
Snowmobiles (lbs per 4 hr visit)	0.06	0.2
Automobiles (lbs per 4 hr drive[a])	0.09–0.41	0.02
Diesel buses (lbs per 4 hr drive[a])	3.22	0.26

[a]Assuming an average speed of 25 mph.

Source: National Park Service (NPS). February 2000a. *Air Quality Concerns Related to Snowmobile Usage in National Parks*. Denver, CO: National Park Service.

Several studies have investigated U.S. households' values for improvements in visibility at various national parks across the country. All of these studies have found a significant WTP by both users and nonusers for visibility improvements. One study in particular (Chestnut and Rowe, 1990) found that the average household in the southeast U.S. would be willing to pay $68 (in 1999 dollars) per year for a doubling of the visual range in national parks in the southeast U.S.

Human Health Benefits

In addition to NO_X, ozone, and PM, PWC emissions typically contain a number of other pollutants, including CO, a conventional air pollutant that is commonly associated with mobile sources. It also includes a number of potentially toxic HC pollutants—benzene, 1,2-butadiene, formaldehyde, and acetaldehyde—and ammonia. As described in Table B-3, inhalation of these pollutants is associated with a wide variety of potential adverse health effects.

The extent to which the health effects listed in Table B-3 result from PWC emissions depends on the level and duration of exposure. Unfortunately, there is too little data and too much uncertainty to reliably estimate the incidence of these health effects. For comparative purposes, however, Table B-4 compares

emissions rates of HCs and CO for snowmobiles (as in Table B-2, snowmobile emissions factors serve as a proxy for those of PWC) and for other vehicles.

Table B-3. Health Effects Associated with Pollutants in PWC Emissions

	Carcinogenic Effects	Other Chronic Health Effects	Acute Health Effects
Particulate matter (PM)	None	Chronic bronchitis	High-level exposure: mortality, acute bronchitis Low-level exposure: cough
Carbon monoxide (CO)	None	Aggravation of cardiovascular disease	High-level exposure: visual and mental impairment
Nitrogen oxides (NO_X)	None	Reduced pulmonary function	High-level exposure: cough, fatigue, nausea Low-level exposure: lung irritation
Benzene	Known human carcinogen	Anemia and immunological disorders	High-level exposure: dizziness, headaches, tremors
1,3-Budatdiene	Probable human carcinogen	Birth defects, kidney and liver disease	High-level exposure: neurological damage, nausea, headache Low-level exposure: eye, nose, throat irritation
Formaldehyde	Probable human carcinogen	NA	NA
Acetaldehyde	Possible human carcinogen	Anemia	High-level exposure: pulmonary edema, necrosis Low-level exposure: eye, skin, lung irritation
Ammonia	None	NA	High-level exposure: eye and lung irritation

NA = Not available

Sources: U.S. Environmental Protection Agency (EPA). Integrated Risk Information System. <http://www.epa.gov/ngispgm3/iris/index.htm.>. As obtained on October 15, 2000a.; U.S. Environmental Protection Agency (EPA). 1999a. *1997 National Air Quality: Status and Trends*. Washington, DC: Office of Air and Radiation.

Table B-4. Comparative Emissions Factors for Snowmobiles and Other Vehicles: HC and CO

	HC	CO
Snowmobiles (lbs per 4 hr visit)	19.84	54.45

Automobiles (lbs per 4 hr drive[a])	0.09–0.44	0.75–3.24
Diesel buses (lbs per 4 hr drive[a])	1.23	4.45

[a]Assuming an average speed of 25 mph.

Source: National Park Service (NPS). February 2000a. *Air Quality Concerns Related to Snowmobile Usage in National Parks*. Denver, CO: National Park Service.

The comparisons for CO are particularly relevant since highway vehicles account for over 50 percent of total CO emissions in the country (EPA, 2000b). Although the measures of vehicle use in the emissions factors are different across vehicles, the rates of HC and CO emissions for snowmobiles are distinctly higher than for automobiles and diesel buses. As a result, national park visitors recreating near areas where PWC use is permitted may be exposed to particularly high levels of CO and certain HCs.

Restrictions on PWC use in national parks could potentially reduce harmful exposures to park visitors and workers, particularly for individuals who spend extended periods in high-use areas. The benefits of these restrictions can be expressed as the value of reductions in the incidence (i.e., the number of cases avoided) of harmful health effects, in particular those effects described in Table B-3. As previously mentioned, the total number of avoided health effects is not known; however, using information from a recent EPA study of the benefits of air pollution regulations (EPA, 1997), Table B-5 provides a summary of "unit" values for selected health effects. Based on a review and synthesis of several health valuation studies, these values represent best estimates of individuals' average WTP to avoid a single case of the health effect. In the absence of more complete information on the total health benefits of reducing PWC use, these values provide a rough sense of the magnitude and relative size of the benefits associated with avoiding specific health effects that may result from acute exposures.

Table B-5. Unit Values for Selected Health Effects

Health Effect	Unit Value (mean estimate) (1999$)[a]
Acute bronchitis	$57
Acute asthma	$41

Acute respiratory symptoms	$23
Shortness of breath (one day)	$6.8

[a]All amounts inflated using the consumer price index available from the U.S. Bureau of Labor Statistics, 2000.

Ecosystem Protection Benefits

To the extent that damages to park ecosystems occur, their cumulative effect is to reduce the "ecological services" that these systems provide to individuals and households across the country. National park ecosystems are particularly valued for their unique biological, cultural, and geological resources and the recreational and other services they provide. A vast majority of park visitors (i.e., users) experience and enjoy the natural systems of the park through a wide variety of recreational activities (wildlife viewing, hiking, fishing, as well as using PWC). However, even individuals who are not park visitors (i.e., nonusers) can benefit from the knowledge that park resources are being protected and preserved. These nonuse values can stem from the desire to ensure others' enjoyment (both current and future generations) or from a sense that these resources have some intrinsic value. Evidence of such nonuse values for park protection is provided in studies that have documented significant WTP by nonusers for improved air quality at parks (e.g., Chestnut and Rowe, 1990) and, more generally, for the protection of unique species and ecosystems (see, for example, Pearce and Moran [1994] for a review of such studies). Restrictions on PWC use in national parks can therefore provide benefits to both users and nonusers in a number of ways by protecting the parks' ecological resources.

B.1.2 Nonenvironmental Benefits

Restrictions on PWC use in national parks can also improve societal welfare in ways that are not directly related to environmental quality in and around the parks. These potential nonenvironmental benefits are described below.

Public Safety Benefits

With the increase in PWC use in recent years has come an increased concern relating to the health and safety of operators,

swimmers, snorkels, divers, and other boaters. A study conducted by the National Transportation Safety Board (NTSB) in 1998 revealed that although recreational boating fatalities have been declining, PWC related fatalities have increased in recent years (NTSB, 1998). PWC accident statistics provided by the U.S. Coast Guard supports the increase in PWC-related fatalities. Within the U.S. five PWC-related fatalities occurred in 1987 and 68 PWC-related fatalities occurred in 2000. However, the peak occurred in 1997, with 84 PWC-related fatalities. Since 1997, PWC-related accidents, injuries, and fatalities have decreased. Following this same pattern, the percentage of PWC out of all boats involved in accidents have decreased from 36.3 percent in 1996 to 29.6 percent in 2000. The increases and decreases in PWC accidents, injuries, and fatalities are comparative to the number of PWC sales and number of PWC owned (Schmidt, 2001).

Restrictions on PWC use in national parks would certainly reduce the number of such incidents in the parks.[1] The primary beneficiaries would be the PWC users themselves, whose safety would be protected; however, these benefits may be implicitly accounted for in the consumer surplus changes (see Section B.2) that these recreators experience as a result of the restrictions.[2] Other summer recreators (non-PWC) might also benefit if they would otherwise be at risk of being involved in accidents with PWC. In addition, PWC accidents can impose costs on NPS and other local state and local government agencies that are responsible for providing medical, rescue, and related assistance. Reductions in PWC accidents in national parks would therefore allow some of the resources devoted to these activities to be diverted to other publicly beneficial uses.

Avoided Infrastructure Costs

Allowing PWC in national parks requires NPS to develop, maintain, and operate an infrastructure to support these activities.

[1]The benefits of these reductions may be offset to some degree by increased PWC usage and accidents in areas outside the parks.

[2]To the extent that PWC users are aware of the safety risks they face, the potential losses to themselves from accidents should already be factored into their consumer surplus from using a PWC. This implies that the safety benefits to these individuals from reducing PWC use are implicitly accounted for (i.e., deducted from) the consumer surplus losses to these recreators.

In particular launch sites and buoys must be designated, maintained, and monitored. The costs associated with these activities vary widely across parks, depending on the physical characteristics of the parks and the level of PWC use permitted.

By restricting PWC use, some of these infrastructure-related costs can be avoided or reduced. As a result some of the resources devoted to these activities can also be diverted to other publicly beneficial uses.

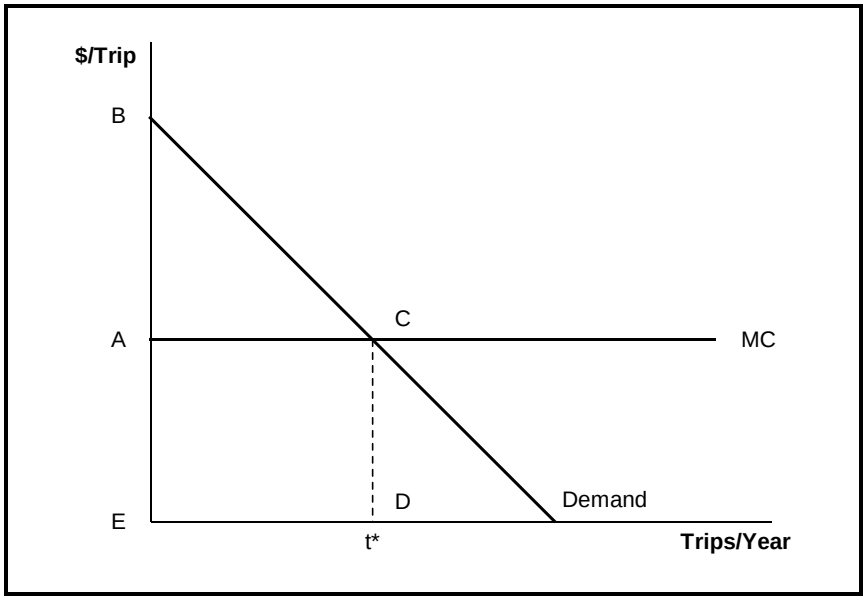
B.2 SOCIAL COSTS OF PWC RESTRICTIONS

The primary losses associated with PWC use restrictions in national parks will accrue to

- PWC users, in particular individuals who will not PWC in the park as a direct result of the restrictions, and
- providers of PWC-related services for park visitors.

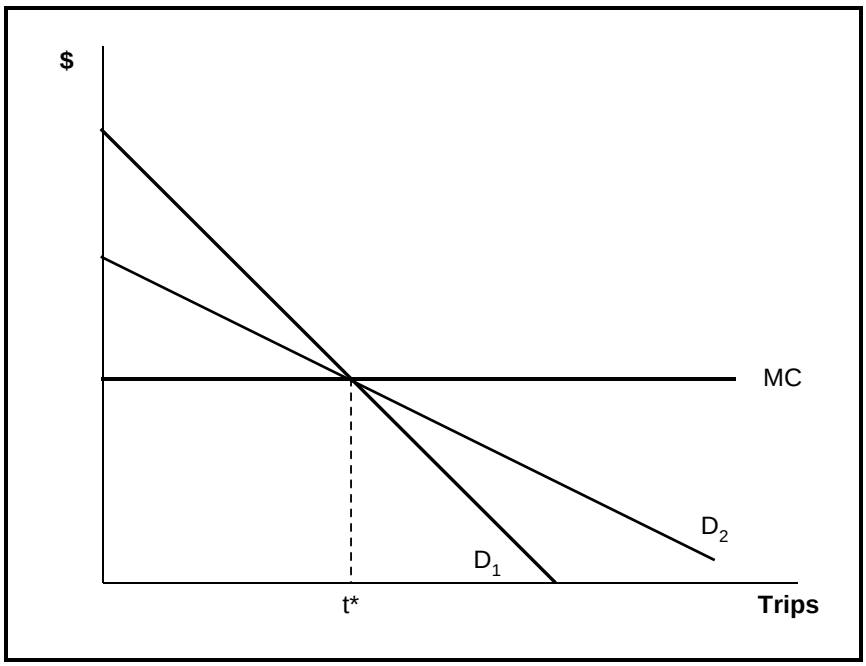
The welfare losses to individual consumers (PWC riders) are measured by their loss in consumer surplus. Consumer surplus is measured as the difference between the total cost of a product or activity to the consumer and the total amount the individual would be willing to pay for that activity. In the context of recreation activities, Figure B-1 depicts an individual demand curve for PWC trips, the marginal cost of a trip (MC, assumed to be constant), and the optimal number of trips per year, t*. The triangle ABC measures the consumer surplus associated with this optimal number of trips—the difference between what the individual paid for the trips, ACDE, and the total WTP for the trips (the area underneath the demand curve), EBCD.

Figure B-1. Consumer Surplus



The extent of the welfare loss to an individual rider depends crucially on the availability of substitute activities. Figure B-2 depicts two alternative demand curves for PWC trips to a particular waterbody. The slope of the demand curve reflects the number of substitute activities available to a particular individual and the preferences of that individual toward those substitutes. The flatter demand curve, D_2, indicates that this individual has a variety of close substitutes for PWC use in this area (these substitutes could include PWC riding in a different area or participating in a different activity such as motorboating). The individual with the steeper demand curve, D_1, has fewer substitute activities he/she enjoys as much as using his/her PWC in this waterbody. If both individuals choose the same number of trips, as in Figure B-2, the person with the steeper demand curve, D_1 (fewer substitutes for PWC use) receives greater consumer surplus from use in this particular waterbody and thus will experience a greater loss in welfare if the waterbody is closed.

Figure B-2. Consumer Surplus and Substitute Activities



The change in welfare for businesses is measured by producer surplus, or the area AP*B in Figure B-3, where P* is the market price of the good, for example a PWC rental. Producer surplus measures the difference between total revenue and variable costs. If the firms face an upward- sloping marginal variable cost (MC) curve, then a decrease in demand, indicated in Figure B-4 from D to D' will result in a lower producer surplus for PWC rental companies.

Figure B-3. Producer Surplus

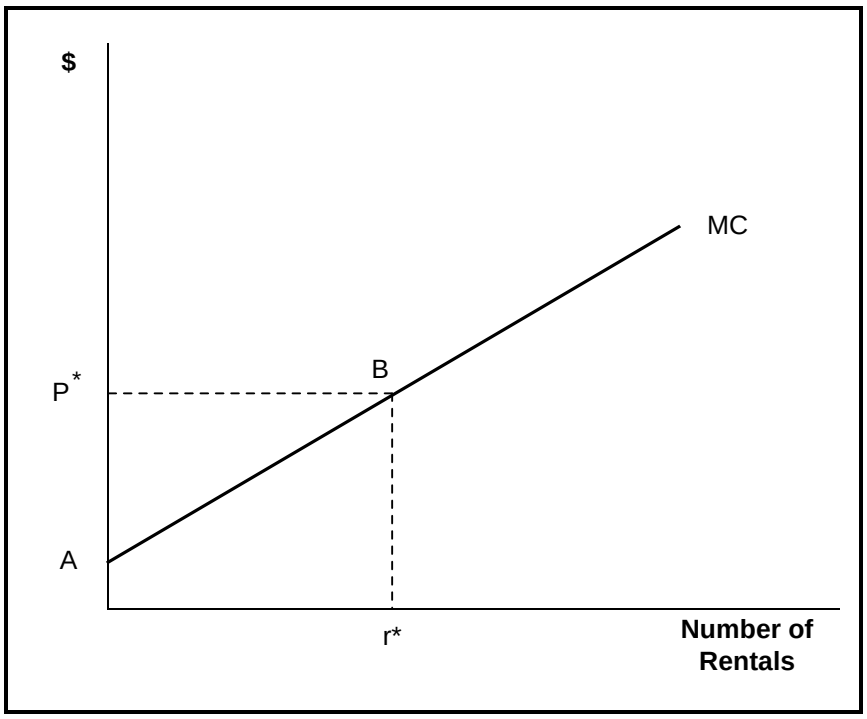
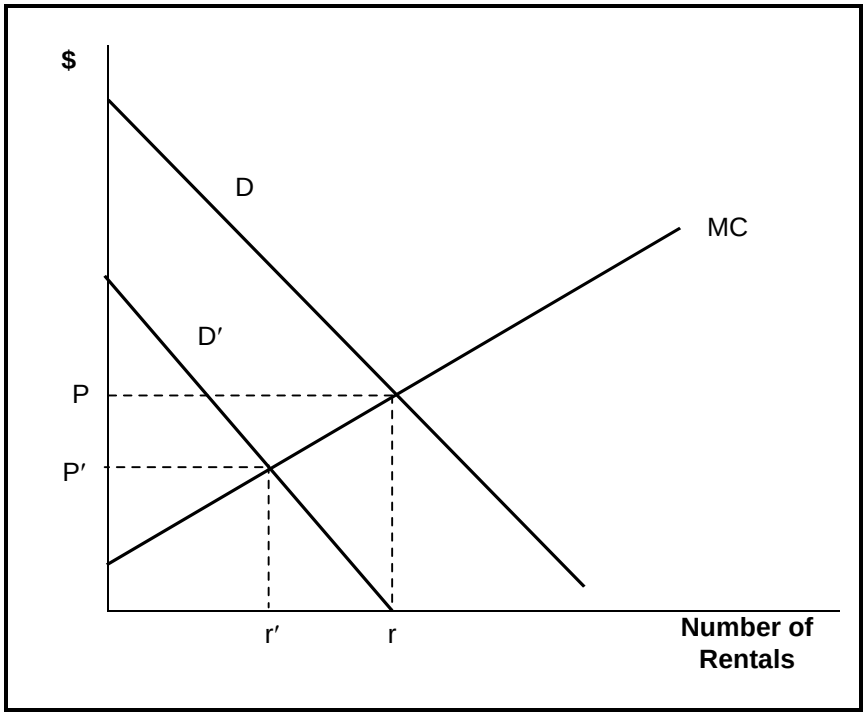


Figure B-4. Producer Surplus and a Change in Demand



If PWC riding decreases as a result of the regulation, then the suppliers of PWC and other tourism-related services will be affected, including rentals and sales of PWC and PWC accessories, lodging, meals, and other tourism-related expenditures. If demand for other types of recreation related rentals increases, then some businesses may experience an offsetting increase in producer surplus.